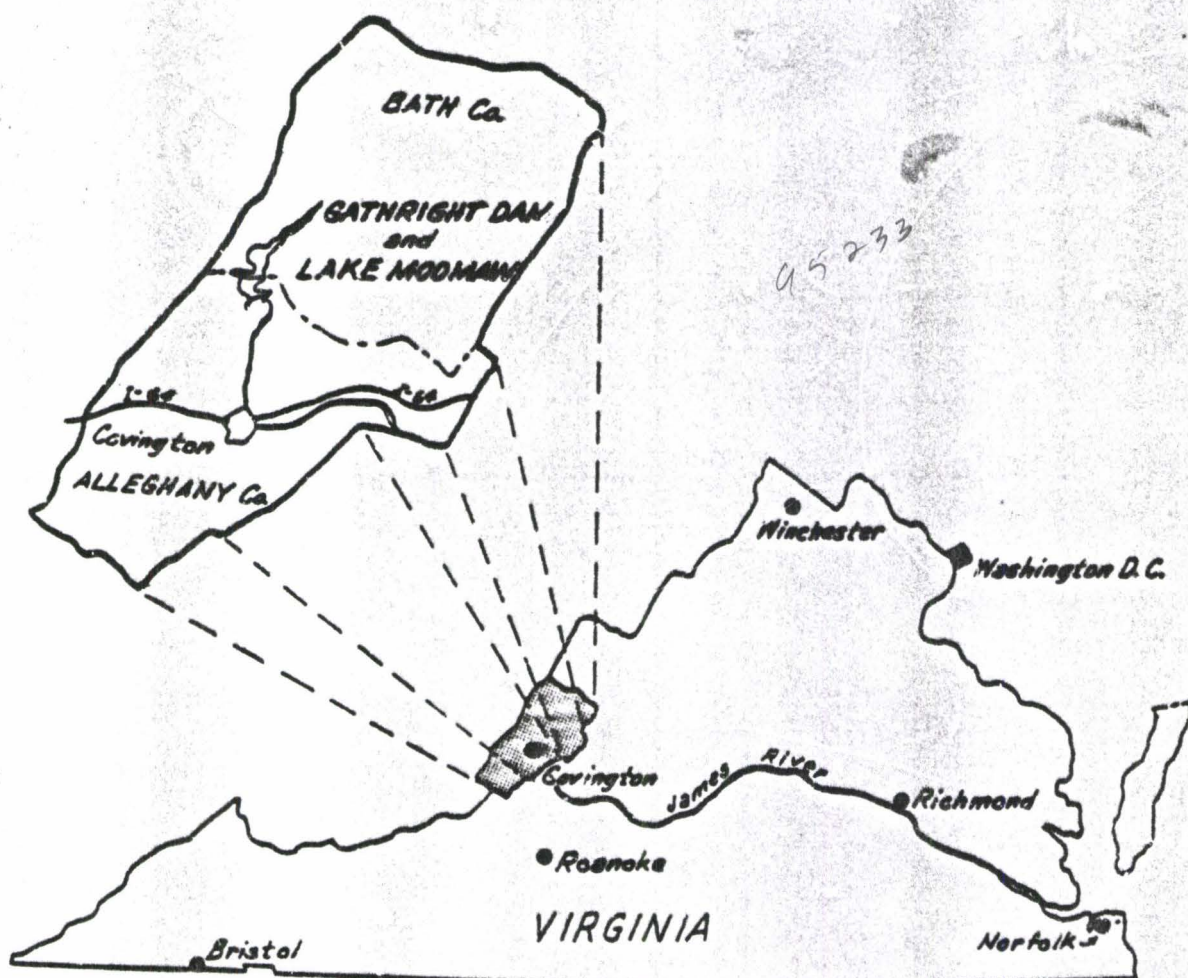


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LEICHTER

GATHRIGHT DAM and LAKE MOOMAW

An Analysis of the Situation



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GATHRIGHT DAM AND LAKE MOOMAW
AN ANALYSIS OF THE SITUATION

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February, 1983

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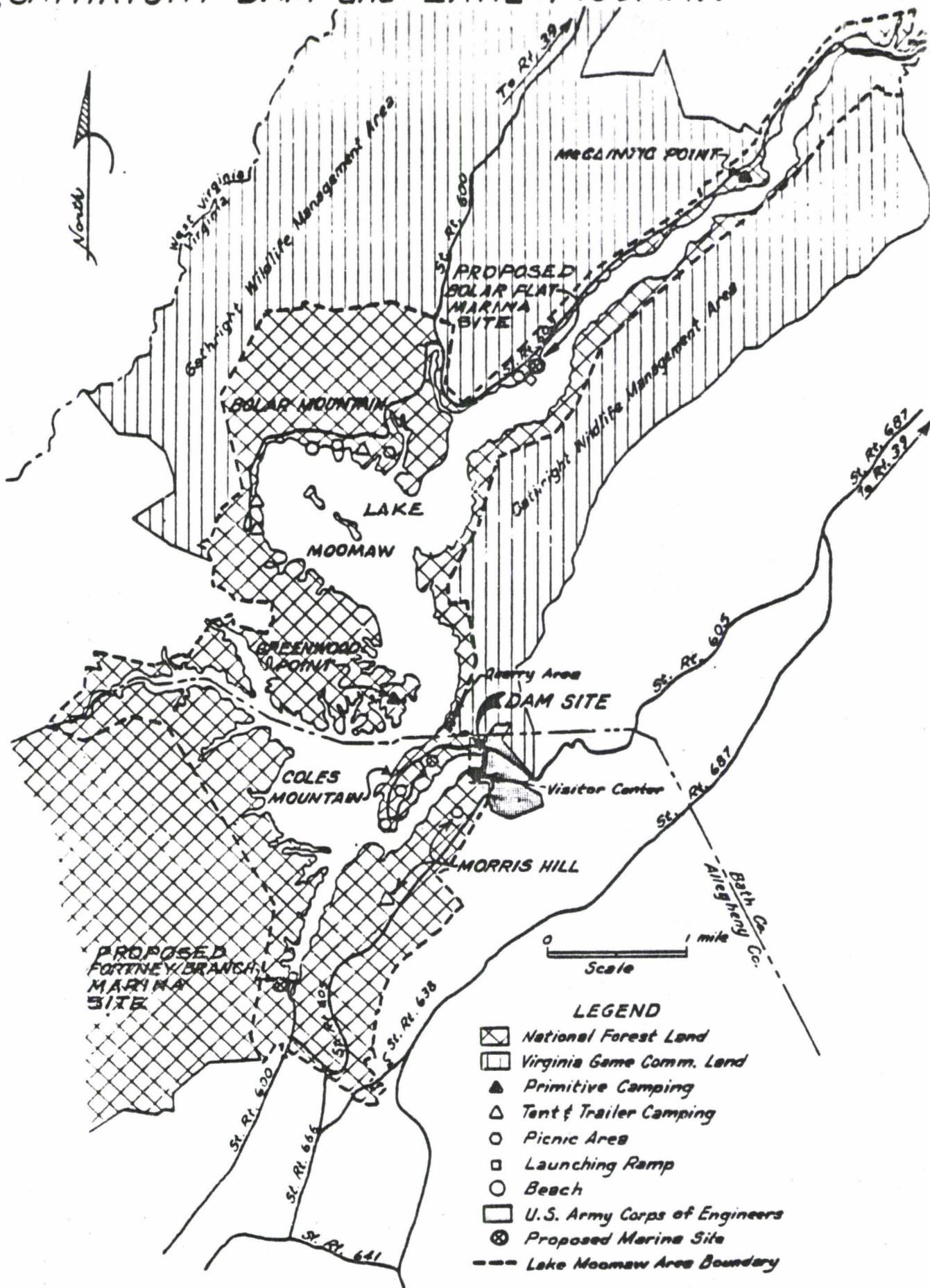
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GATHRIGHT DAM and LAKE MOOMAW



CHAPTER I

INTRODUCTION

Gathright Dam and Lake Moomaw is a new recreation complex located in the Alleghany Highlands of Virginia. The area has unknown use patterns, unknown user demands, unknown capacity of certain facilities (lake) and certain types of facilities (oil flush toilets and treatment plants) which are costly to operate and maintain.

This portion of Virginia is lacking in water-based recreation (lakes). Local people and business leaders view Gathright Dam and Lake Moomaw as an opportunity to help the local economy by attracting people and new industry to the area. The recreation complex is within an hours drive of 650,000 people. There are 59 million people within a day's drive (1980 census). The southern portion of the complex is very accessible. This transportation net includes Interstate 64 and 81, U. S. Routes 220 and 60. Interstate 64, U. S. 220, and U. S. 60 are within 10 miles of the south end of the lake. The north complex is served by State Route 39, from U. S. 220, and is not as accessible as the south complex to population centers. (map of Gathright Dam and Lake Moomaw.)

Gathright Dam and Lake Moomaw is located on the Jackson River, a tributary of the James River. The dam site is 43.4 miles above the mouth of the River, and 19 miles north of the City of Covington. It is about 215 miles southwest of Washington, D. C. and approximately the same distance south of Pittsburg, Pennsylvania. Richmond, Virginia is approximately 180 miles east of the lake. The reservoir impounds water in both Alleghany and Bath Counties of Virginia. The area surrounding the recreation complex is rural in nature.

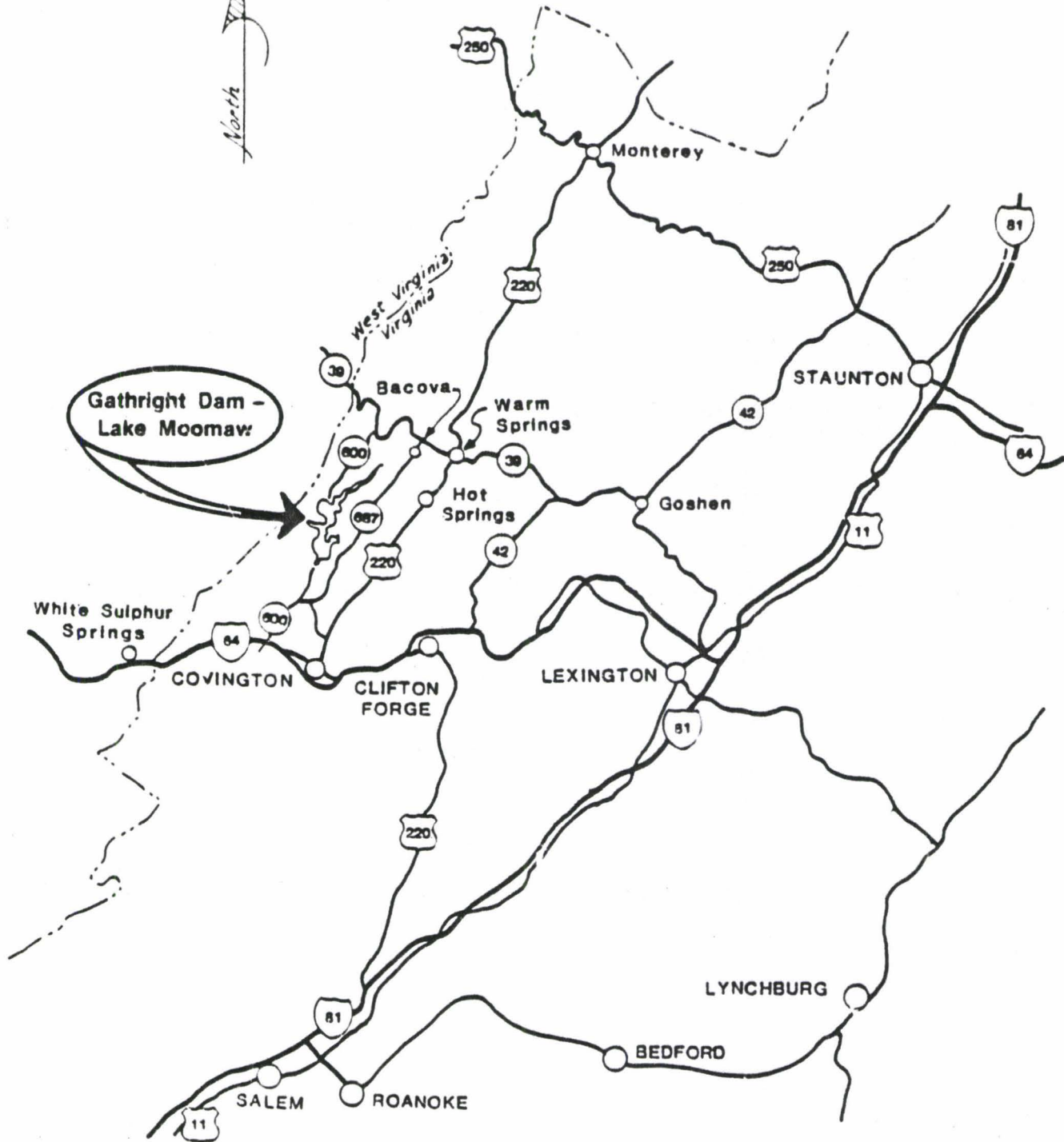
BACKGROUND

The project was first authorized by Congress in 1946 for Flood Control. Planning was suspended by the Corps of Engineers in 1954 when it appeared that economic justification was marginal. In 1964, restudy of the Gathright project indicated that a favorable economic ratio prevailed. This study showed that the dam and reservoir would be operated for:

- ...Flood Control
- ...Increasing low flows for improvement of downstream water quality
- ...Providing opportunity for water-based recreation
- ...Creating suitable habitat for trout in the Jackson River downstream from the dam

Annual project benefits attributable to the Gathright Dam by the Corp of Engineers showed that recreation, as a project purpose, represented approximately 22 percent of the total benefits (Design Memorandum No. 14; Corps of Engineers, 1972).

Location Map



Construction of the project began in 1965. The entire project was essentially completed in 1981. Just prior to completion Congress changed the name of the project to "Gathright Dam and Lake Moomaw". The administration and management of the lake and recreation facilities were transferred from the Corps of Engineers to the U. S. Forest Service on July 12, 1981. The Corps of Engineers retained approximately 200 acres which included the dam, visitor center, a small picnic area, maintenance area, and a fishing area immediately below the dam.

The lake contains 2,530 surface acres and approximately 43.5 miles of shoreline at elevation 1582 (conservation pool). Most of the shoreline is wooded and very steep. The lake is approximately 12 miles in length.

Gathright Dam and Lake Moomaw is within the boundary of the George Washington National Forest. The Gathright Wildlife Management Area (owned by the State of Virginia) contains many acres of public land open to hunting adjacent to the project. The total National Forest ownership in this area exceeds 20,000 acres. The entire lake is surrounded by public land with one exception. The Corps of Engineers granted an adjacent private landowner the right to construct a private boat dock in the Big Lick Branch of the lake as partial compensation for land taken.

The general climate of the region is characterized by warm summers and moderate winters. Annual precipitation averages about 41 inches which includes an average snowfall of 25 inches. Annual distribution of precipitation is fairly uniform. Duration of the snow pack is not long.

The lake lies in an area of varying topography. The mountains in the vicinity of the reservoir range in height from 1,000 to over 3,000 feet in elevation. The entire area is picturesque, isolated, and has a rugged, wilderness character.

The only activities available to the public in 1981 were boat launching and the use of the lake. Final construction of the remainder of the recreation facilities were finished during the fall and winter of 1981-82. The lake reached an elevation of 1582 feet in January 1982. The entire area was open to the public in April 1982.

Developed facilities available to the public in the spring of 1982 included the following

<u>FACILITIES</u>	Picnicking Units	Camping Units	Electric Hook-up	Picnic Shelter	Fee Area	Fishing Nearby	Boating	Hunting Nearby	Drinking Water	Sanitary Facilities	Showers	Boating Nearby	Swimming
SOUTH END													
Fortney Branch Boat Ramp						x	x	x	x	x			
Morris Hill Campground		55			x	x		x	x	x	x	x	
Morris Hill Picnic Area	20					x		x	x	x			x
Coles Mountain Picnic Area 1	40			1		x		x	x	x			x
Coles Mountain Picnic Area 2	38			1		x		x	x	x			x
NORTH END													
Bolar Flat Boat Ramp						x	x	x	x	x			
Bolar Flat Picnic Area	52			1		x			x	x			x
Bolar Mountain Recreation Area	118	90	21	2	x	x		x	x	x	x	x	x
Greenwood Point		5								x			
(primitive camping)													
--Sewage dump station located in campgrounds													

In addition to the above, Coles Mountain Point in the South Complex was opened for lake bank-fishing and sailboat launching and retrieving. In the North Complex McClintic Point was opened for overflow camping along with some lake bank-fishing areas.

Current Ranger District administrative boundaries were retained due to existing transportation nets and cost of operation. The South Complex was assigned to the James River Ranger District and the North Complex was assigned to the Warm Springs Ranger District.

Statement of the Problem

Gathright Dam and Lake Moomaw is a new recreation development on which no data have been obtained to indicate user demand, patterns of use, or carrying capacity. The area contains new facilities which had not been tested prior to the season of 1982 to determine problems or deficiencies with them. Some of the facilities, such as a treatment plant and oil flush toilets, require close attention and are costly to operate and maintain. With cutbacks

in operating funds for recreation and the loss of the YACC Program, use patterns must be determined to prepare manning schedules to provide the necessary protection and services at the least cost.

The recreation facilities that were constructed by the Corps of Engineers were based on demand projections made in 1966. These projections were based on the 1960 population within 50 miles of the Project (Design Memorandum No. 5, 1966) plus projected population increase minus existing and projected recreation visitation at other recreation areas within the zone. The Corps of Engineers estimated that initial annual attendance would be 300,000 which would occur three years after the project was placed in operation. Their estimate of ultimate annual attendance was 400,000. In determining the instant design load the following percentages, by activities, were used:

1. Boating -- 12% of visitation
2. Camping -- 9% of visitation
3. Picnicking -- 22% of visitation
4. Swimming -- 25% of visitation
5. Other -- 32% of visitation (hiking, sightseeing, nature studies)

No explanation was given on the origin of the percentage by activity.

Based on the demand projections it appears that the area was overdesigned for picnicking and other activities (sightseeing, nature study, etc.) and that the number of facilities designed for camping, swimming, hiking and boating is insufficient. Carrying capacity does not appear to have been considered, nor the demand that a large body of water would generate in this area for various recreation activities.

Based on the above and discussions held with various individuals and groups the following assumptions were made:

1. Boating -- the majority of boating activity would originate from the south due to population centers and the transportation net.
2. Picnic Areas -- more picnic facilities were developed than needed on project area. This is based on the population of the area and existing picnic facilities and their use pattern. (Douthat State Park, Longdale Recreation Area and Lake Sherwood)
3. Swimming -- this activity is concentrated in the north complex area with the majority of the population centered south of the project. It would appear that additional capability is needed in the South Complex.

4. Camping — due to the attraction of water and the potential for destination camping, insufficient camping facilities were provided including primitive type camping facilities. The campgrounds were not designed for use in late fall, winter, or early spring. None of the restrooms or water systems were built for freezing weather even though camping in these periods of the year can be enjoyed by hunters and other potential users. Many of the campers would have boats and trailers due to the presence of the lake. There are no facilities for campers to park boat trailers.
5. Fishing — the lake would be very popular for fishing due to distance to lakes of equal or larger size.
6. Economy -- the lake would not attract any major industries but would help the local economy.

Limitations

The area had little to no advertisement in recreation area guides. The only advertisement of the opening of the facilities was in local newspapers. The area was originally scheduled for completion in 1971, however, due to construction delays it did not open until 1982. Therefore this study is limited to one season of data which may not accurately reflect future use patterns when the area becomes better known. However, this limitation is expected to only impact overnight facilities such as camping. There may be problems with the data due to the novelty of being a new area. As the novelty factor wears off use patterns may change. Therefore visitation and patterns will need to be closely monitored for at least a three year period. In addition, due to problems with some systems and equipment (water, campfire grates and sewer) when the area was opened in April of 1982, the use patterns for the pre-season may not be accurate or reflect a true pattern.

Significance

The study is timely as it will provide management with information to use in making decisions on the administration and management of this new facility. It will provide the opportunity to direct the use of the area for maximum benefit to the visiting public while protecting the resource from being overutilized and consequently lowering the quality of the experience. Also, with the reduction in funding and loss of Human Resource Programs, it will help guide management on how to best meet the demands with limited resources.

Purpose of Project

Gathright Dam and Lake Moomaw is a new recreation complex. Problems, use patterns, and needs are unknown. The opening of this new facility coincides with reduction in personnel ceilings and constrained budgets. This paper is prepared to analyze the complex and make recommendations for future direction in its management. Being a new recreation project the timing is most appropriate.

CHAPTER II

REVIEW OF LITERATURE

As a new recreation complex, Gathright Dam and Lake Moenaw gives the administrator of this area an opportunity to plan and guide future events. In 1980 Knudson wrote in Outdoor Recreation "People have more free time, more real income, greater mobility, better education, greater exposure to new ideas and places, and more of other basics to increase opportunities to participate. The demand for recreation facilities and services will continue to expand". This new complex has many unknown factors — use patterns, capacity, use demands, equipment, etc. The area will need to be studied and monitored for a few years to obtain complete answers to questions and problems. The answers and best direction for management will not come from a one year study. A literature review on management principles will help define some principles to be used during the study period to direct future management for this area.

Recreation Carrying Capacity

Recreation carrying capacity has received the attention of social scientists for over a decade. The FSM 2331.32 states that "Sites will be designed to ensure that the people at one time (PAOT) capacity of the site is in proper relationship to the desired ROS (Recreation Opportunity Spectrum) class and the ability of the site to withstand use." In 1980 Urban Research and Development Corporation in a study of 12 reservoirs nationwide from 1978-1980 wrote in Recreation Carrying Capacity Handbook "Recreation carrying capacity means different things to different people. Environmentalists, ecologists, and biologists tend to view carrying capacity primarily in terms of resource degradation and restoration. Sociologists and psychologists are concerned mainly with the quality of user experiences and the effects of crowding on human behavior. Site planners often view capacity in terms of the physical space required to effectively and safely conduct an activity. And administrators frequently consider capacity as it relates to management policies, costs, personnel, user demand, and the feasibility of exercising controls on the use of resources". All of these perspectives are important when evaluating carrying capacity of recreation areas. However, social overcrowding and resource overuse are probably the most important to deal with in the management of areas. It would be next to impossible to develop an easy-to-use method of determining carrying capacity that would include all factors.

Knudson in Outdoor Recreation wrote "a foundation for recreation resource management is an understanding of the principles of carrying capacity. Its use is for both planning and management. Carrying capacity is the level of use a renewable resource can withstand and still remain productive. It is a long-range concept, in which the short-run actions must be considered in light of their long-term effect." The social, resource

and design capacities will need to be considered in formulating management direction.

Recreation User Fees

The basis for the fee system is the Land and Water Conservation Fund (LWCF) Act of September 3, 1964—78 Stat. 897, as amended; 16 U.S.C. 120. The FSM 2332.2 provides instructions and guidelines that direct the recreation fee program as provided under current statutory authority. The objective of the Forest Service fee system is to increase use fees over time, to bring them more in line with costs, and to reduce public competition with the private sector.

In 1982, Curtis G. Fuller, Chairman of the Board, Woodall Publishing Company, in a speech to the New Jersey Campground Owners Association gave the results of surveys made in 1973, 1976, 1979, and 1982 by the A. C. Nielsen Company. In this survey camping was rated number three among adults in outdoor sports activities; two out of every three camping occasions involved the use of a public campground. Only about 10 percent of campers used public campgrounds because they were cheaper. The remainder favored the design and layout of public campgrounds. Past studies by Woodall, who publishes Woodall's Campground Directory, indicated that most competition from public campgrounds comes from State Parks and not Federal areas.

Fuller reported that in 1982 the base camp rate in the United States averaged \$6.96 per night. This base rate did not include hookups such as electric, water and sewer. He also reported that the KOA has been increasing their rates by 10% annually for the last three years. Their 1982 average was approximately \$10.00. Fuller recommended a camping charge of \$7.00 to recover operating costs of a recreation area.

Maurice A. Unger in Real Estate - Principles and Practices (1974) reported that physical elements (location, size, frontage on water and roads, topography, accessibility, climate) and Social elements (population trends, noise, attitudes, design) all influence values of property. Some characteristics of value are utility (power of a good to fill a need), scarcity (related to supply and demand), and demand, all of these principles are used in real estate appraisals. All campgrounds are not exactly the same and not all campsites within a campground are exactly the same. Campsites within a campground and different campgrounds will have different amenities and value. Don Gross of Virginia Realty in Covington, Virginia stated that different tracts of land and houses have different value due to such factors as road accessibility, proximity to water such as streams or lakes, esthetic views, privacy and vegetation. These values determine the price that is placed on a tract of land and is supported by comparative appraisals of similar tracts and their selling price.

Mark J. Goebel prepared a report in 1981 on a Differential Campsite Pricing System on the Bradford Ranger District of the Allegheny National Forest. The term "differential pricing" refers to a system that charge higher daily fees at certain campsites within certain campgrounds. The area he studied was similar to Gathright Dam and Lake Moomaw in the sense that the campgrounds were located on a Corp of Engineer constructed reservoir and the campgrounds were Development Level 4, except the primitive campground which was Development Level 2. Goebel provided guidelines to consider in implementing a Differential Campsite Pricing System.

In Goebel's study the preferred differential in pricing ranged from \$3.00 to \$4.00. He stated that it was a viable alternative that a manager may utilize in order to effect changes in use patterns and increase revenues with a minimum cost of implementation and maintenance.

Use Patterns and Determination

In discussion with the Park Superintendent at Douthat State Park it was found that the camping and day use areas are operating at or near capacity and have been for the last three years. The same is true for Blue Bend and Lake Sherwood on the Monongahela National Forest, seven air miles north of Gathright Dam and Lake Moomaw. Longdale Recreation Area (picnic and swimming) has been operating at or near capacity for the last three years. These public recreation areas draw from the same population centers as Gathright Dam and Lake Moomaw. The private campgrounds that are located near water (rivers) cater primarily to campers who rent campsites for the entire year. The other public and private recreation areas in the area are not directly related to water and are not expected to draw use from Gathright; in fact the reverse may be true.

Fuller stated that "we are looking at a slowly increasing number of RV (recreational vehicle) campers and an increasing number of tent campers. In 1982 there were more tent campers than RV campers. Tent campers represented 44.6 percent of all campers and RV campers represented 39.1 percent with the remainder being backpackers and similar type of campers".

Stephen L. Smith in An Exegesis of Outdoor Recreation Research, reported that 60 percent of weekend trips terminated within a two-hour drive of the city center and the most frequently traveled one way distances were seventy-five miles. In the same article he reported that a recreational highway showed one daily peak (either at midday or in the early evening); a weekly maximum during Saturday and Sunday; and a yearly maximum in the summer.

Alvin L. Bertrand and James G. Hoover in The Characteristics of the Users of Toledo Bend: A Study of the Development Potential of Waterbased Outdoor Recreation found that the median distance traveled was about 150 miles with 80 percent of the users traveling less than 250 miles. The furthest distance reported was 2,000 miles. He found that the median size of

parties was four persons and the majority of the visitors were from age 25 to age 54. They found that distance traveled had a significant effect on participation at the reservoir. However, a drive up to three hours did not appear to be a deterrent. In the same study they found that the farther people traveled the longer they intended to stay.

Urban Research and Development Corporation in Recreation Carrying Capacity, Design and Management Study noted the leisure year is now 123 days long — with seven three-day weekends, and an average of 16 vacation days per worker which represents more available leisure time than in the past. They found that 80 percent of the visitors to reservoir areas participated in more than one activity; those engaged in day use activities recreated for more than five hours, 87 percent of those engaged in camping stayed for a period greater than 2 days. They also found that 95 percent of campers at reservoirs were destination campers; 60 percent traveled less than one hour to get to the reservoir areas; 36 percent traveled less than 30 minutes and only eight percent traveled more than three hours.

According to the Recreation Information Management (RIM) Handbook, recreation use data are the most widely distributed information obtained from the RIM system. These data are used for supporting budget levels, planning, development of policies and regulations, etc. The need for less expensive and more accurate, more reliable, and more consistent recreation use data is widely acknowledged. Dennis B. Jenson in 1982 developed a system, Recreation Use Estimation - The Visitor Count Method, that utilized a TI-59 programmable calculator which would calculate RVD's for (1) developed camping, (2) developed day use, (3) dispersed overnight use, and (4) dispersed day use. The system utilized preselected random samples over the use season. This is essentially equivalent to an instant count for the day. Most districts have TI-59 calculators and with the attached PC-100 printer the program is quick, economical, and satisfactorily accurate in determining RVD's of use at recreation areas. This system appears to be applicable to the Gathright Dam and Lake Moomaw recreation complex.

CHAPTER III

PROCEDURES

Introduction

Gathright Dam and Lake Moomaw is a new recreation complex which was opened for public use in 1982. Accurate information on type of use, where visitors would come from, patterns of use, capacities, problems, manning needs, etc. is not available. There is an opportunity to provide direction for the future management of the area. The opportunity exists to develop a management plan to provide the most economical approach in the future administration of the area while satisfying user demand to the extent practical. To begin to do these things data is needed on Gathright Dam and Lake Moomaw Recreation Area.

Approach

The main thrust of this project was to study Gathright Dam and Lake Moomaw during the first full year of operation. Information was needed to provide direction for management of the area. Use data was collected to provide information from which predictions and recommendations can be made. From this each district can prepare a better Operation and Maintenance Plan. Future needs can be anticipated, and with monitoring of use patterns, priorities can be set on additional facilities or modifications to existing facilities.

Collection of Data

Population data were obtained for the area within 50 miles of the lake. Contacts were made with operators of similar public recreation areas within the area concerning their visitor use for the last three years. Since this lake is the only body of water in this area large enough to handle power boats, boat registration data was obtained for all cities and counties within 50 miles of the lake. Forms were developed (see Appendix A) to obtain information on use at the area. Area administrators collected the data (instant counts). Type of data collected included:

I. Activities

A. Camping: (By individual campground)

1. Type of equipment used
2. Activities engaged in
3. Number of people

4. Number of vehicles
5. Sites utilized
- B. Boat Launch Area (at each launch site)
 1. Three times per day
 - a. Number vehicles
 - b. Average number per vehicle
 - c. People bank fishing
 - d. Time to launch or retrieve boats
- C. Lake Surface Use (two observation points)
 1. Two times per day
 - a. Number of power boats
 - b. Number of non-power boats
 - c. Number of boats - water skiing
 - d. Number of boats - sailing
 - e. Number of boats - fishing
 - f. Number of boats - sightseeing
- D. Day Use (by each area - swimming, picnic)
 1. Number of vehicles
 2. Number of people
 3. Weather conditions

II. Other

- A. Informal discussions with users by area administrators.
- B. Guest registration of campers by volunteers.
- C. Camping fee envelopes were collected.

The area administrators and employees were instructed in the use of the forms. Scheduling of these employees was such that the forms were completed during the time they were performing their planned work. As a

result of equipment breakdowns a few gaps occurred in the data (missed counts on some days), however this was an insignificant percentage of the total. The fee envelopes were to be used to determine the origin of visitors by zip codes. However, since a high number of campers did not complete that portion of the envelopes they were not used. A guest register maintained by volunteers was used in place of the fee envelopes. This only covered the main use season (Memorial Day to Labor Day).

During the literature search an effort was made to locate a system dealing with determination of carrying capacity. Recreation Carrying Capacity Design and Management Study by Urban Research and Development Corporation (Technical Report R-80-1, 1980) was used. A sample of this system is in Appendix B.

A system to determine use by Recreation Visitor Day was needed. The system Recreation Use Estimation - The Visitor County Method (1982) by Dennis B. Jensen was used.

The day use data for the North Complex for the swimming beach and two picnic areas were combined on one form. To utilize these data it was necessary to divide them by area. This was done by using sample vehicle counts made in parking lots and compared with sample counts made of people using the facilities. To further divide the data, discussions were held with the area administrator, workers, and visitors to develop percent of use by area. The total use data by area for these areas is not satisfactorily accurate.

Treatment of Data

After the visitor use data were collected they were reviewed and divided into three periods:

1. Pre-season - (April 1 to Memorial Weekend)
2. Season - (Memorial Weekend through Labor Day)
3. Post-Season - (Labor Day through November)

These data were used to determine use patterns and user characteristics at different sites. The data were also used to determine turnover rates, average size of groups, and participation in activities.

The boating registration and population data were used to predict where the users would originate in relation to the project area and transportation net.

The counts obtained were used to test Dennis B. Jensen's procedure using the TI-59 to evaluate whether it could be used in this area for determining RVD of use.

Site specific data were used to determine social carrying capacity. Development capacity was determined from the facilities (parking lots, campsites, etc.) constructed on the ground. Instruction Report R-80-1 by Urban Research and Development Corporation was used as the model for development of Site Social and Resource Capacity Guideline for the area.

CHAPTER IV

ANALYSIS OF DATA

POPULATION

The primary area of influence for this recreation complex is defined as the counties and cities within 50 miles of the area (Appendix C). This area has a population of 647,721 people (1980 census). This population was analyzed in relation to the transportation road net to determine the relationship of the population to the project area. It was found that 78 percent of the population would logically use the roads that serve the South Complex while 22 percent would use the roads that serve the North Complex (Figure 1, 2 and 3). This area experienced a nine percent increase in population for the decade 1970-80. The national population growth for the same period was an 11 percent gain while the South Atlantic Region had a gain of 20 percent. It is estimated that the nine percent gain will continue for the next decade (Analysis of the Management Situation - Land and Resource Management Plan, GWNF - January 1983).

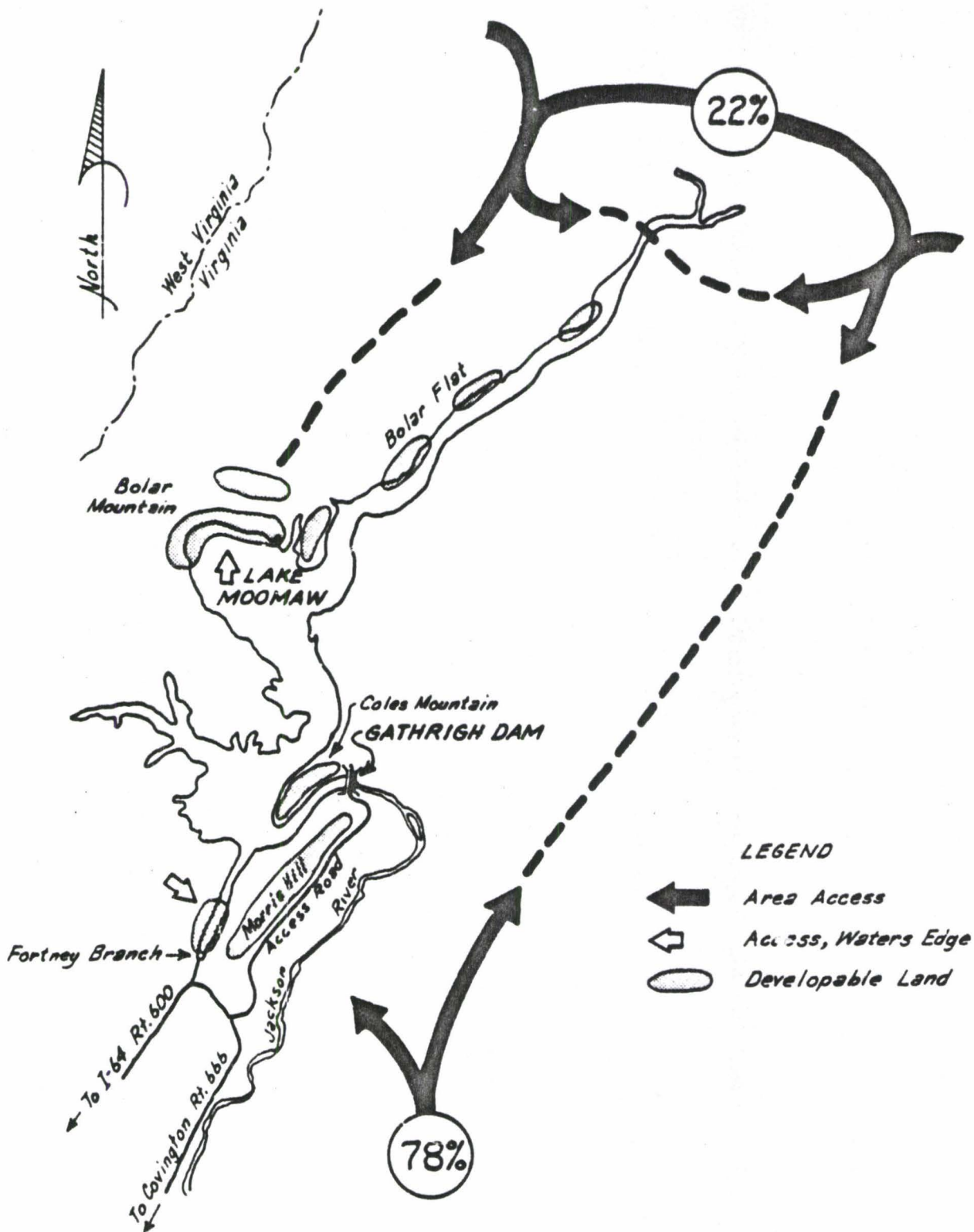
The population data indicated that there will be more impact on day use areas in the South Complex than the North Complex due to road standards, driving time, and accessibility. With the amount of leisure time available it is expected that Gathright Dam and Lake Moomaw will be very attractive to boaters, campers, etc.

OTHER PUBLIC AREAS

Blue Bend and Lake Sherwood Recreation Areas on the Monongahela National Forest, Douthat State Park, and Longdale Recreation Area draws from the same population area as Gathright Dam and Lake Moomaw. (These areas have lakes that are small in comparison to Lake Moomaw.) They reported that picnic use has remained the same for the last three years and that they had available picnic facilities that were not fully utilized. They also reported that swimming use has been increasing with swimming facilities at or near capacity. Their campgrounds were used at capacity during the summer season and they had no additional facilities.

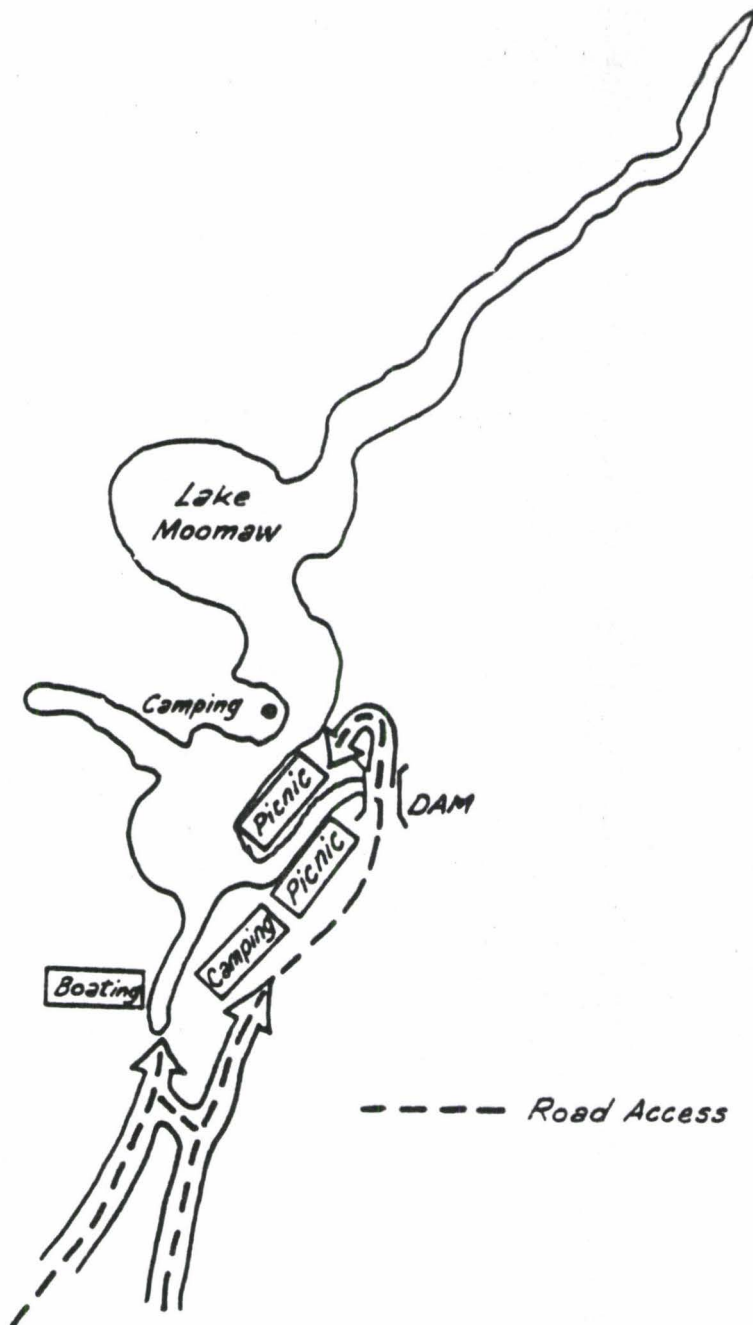
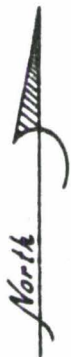
BOATING

Registration data on power boats were obtained for all counties and cities, within 50 miles, for each year since 1976. From 1976 to 1980 the number of registered boats only increased by approximately 300 for the area that the South Complex would serve and approximately the same for the area that the North Complex would serve. From 1980 to 1982 the number of boats increased by more than 300 each year. See Table 1. This increase was



POPULATION DEMANDS AND TRAVEL ROUTES

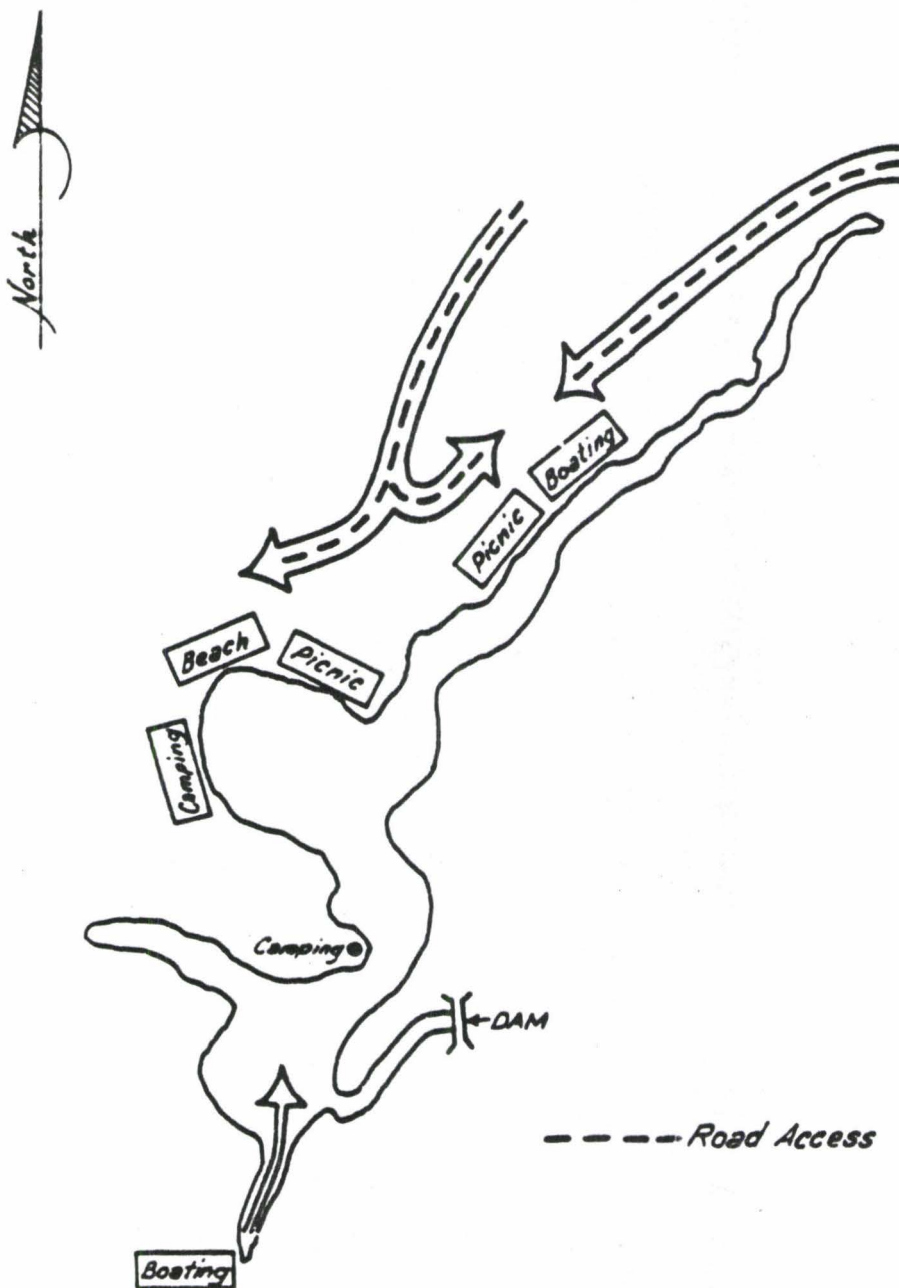
Figure 1



SOUTH COMPLEX

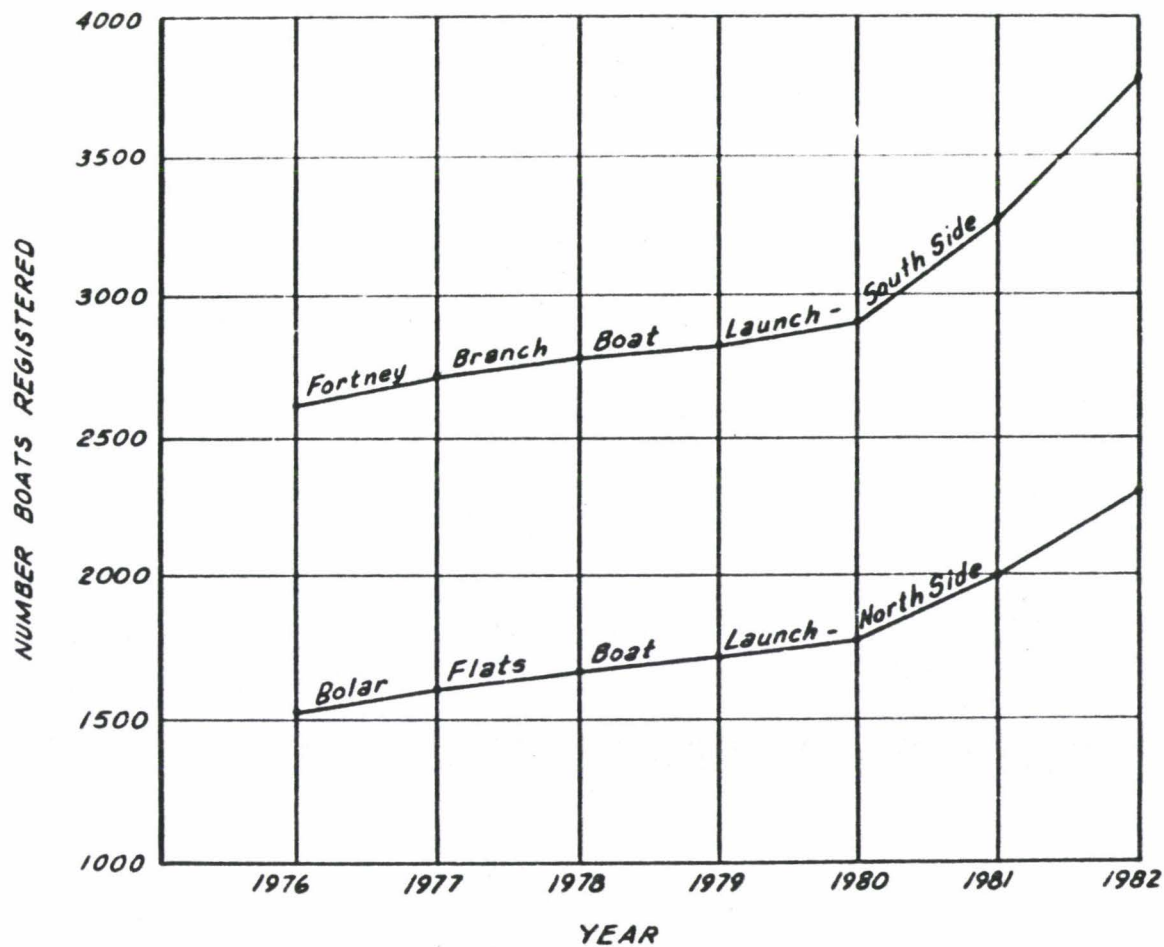
Flow of Users

Figure 2



NORTH COMPLEX
Flow of Users
Figure 3

TABLE 1
BOAT REGISTRATION WITHIN 50 MILES



attributed directly to the influence of Gathright Dam and Lake Moomaw. The registration also showed that more boating pressure can be expected from the boat launch site at Fortney Branch (South Complex) than at Bolar Mountain (North Complex). This also compared favorably with the population of the area since 78 percent of the people within 50 miles live southwest of the lake.

Fortney Branch showed more boats launched than Bolar Flats. See Figure 4 and 5. The period of 3:00 p.m. - 8:00 p.m. consistently showed more boat launching than at any time during the day. This difference was greater at Fortney Branch than at Bolar Flats. Week-ends showed the largest use except when Westvaco had a long break. The shift change of 3:00 p.m. at Westvaco also contributed to high launch numbers late each day at Fortney Branch. Fortney Branch consistently exceeded developed parking capacity on week-ends (1:00 p.m. Friday to 6:00 p.m. Sunday) from April through August. (Table 2,3 and 4)

The average size of boating groups varied by month:

April --- 3.0	May --- 3.2	June --- 3.4
July --- 3.8	August --- 3.9	September --- 3.2
October --- 3.2	November --- 3.0	

This reflected a change in purpose of the boat trip. The period April - May and September - November represented the period when the primary purpose was fishing and/or pleasure boating. Water skiing and pleasure boating were most popular from June through August.

The turnover rate was 2.4 at Fortney Branch and 2.1 at Bolar Flats.

In 1982, the lake was used 91 percent of the time by power boats and nine percent by non-power boats (sail, canoe, john boat). The boat trip purpose is reflected in Figure 4.

The water-based activity determined the length of time spent on the water.

ACTIVITY	AVERAGE TIME SPENT
Fishing	8 hours
Skiing	4 hours
Sailing	7 hours
Sightseeing	5 hours

It took approximately 7-20 minutes to launch a boat, depending on the experience of the boater.

Both Fortney Branch and Bolar Flats have paved parking lots and oil flush toilets with holding tanks.

Figure 4
Boat Trip Purpose

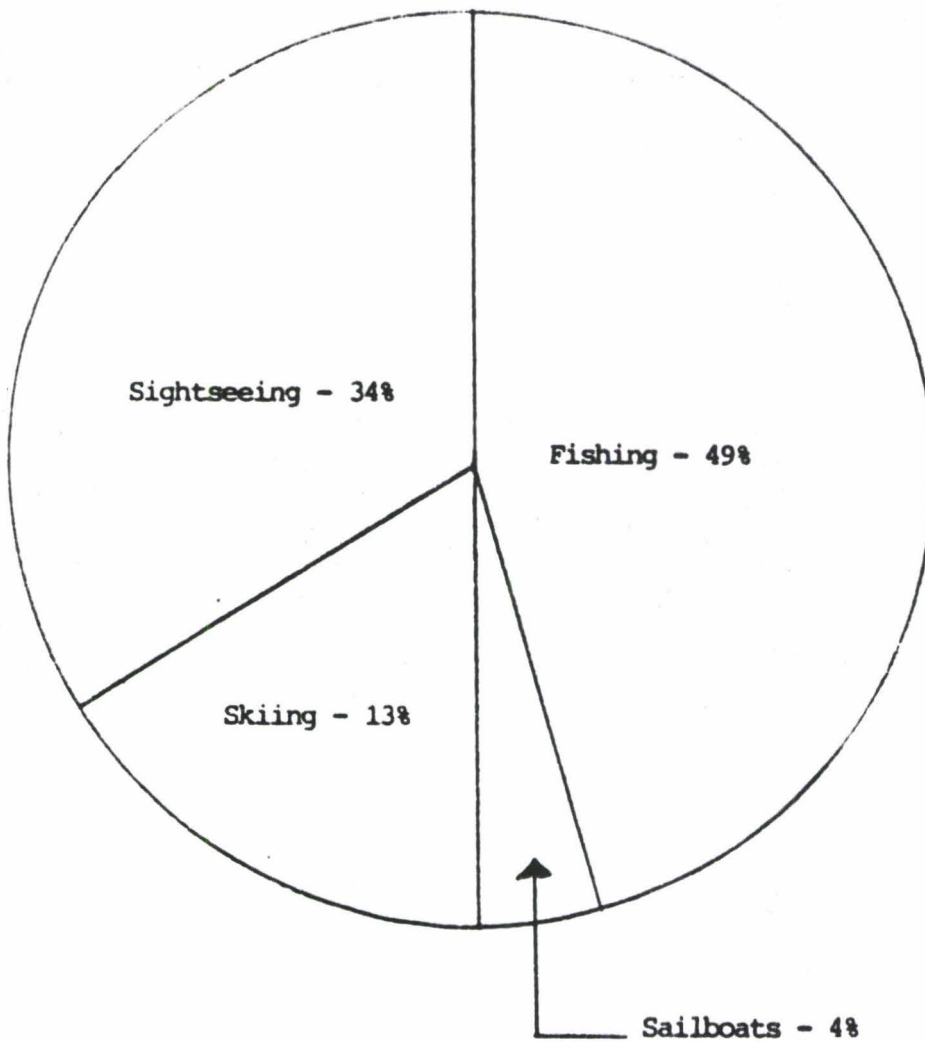


TABLE 2

FORTNEY BRANCH BOAT LAUNCH
Time of Day by Month

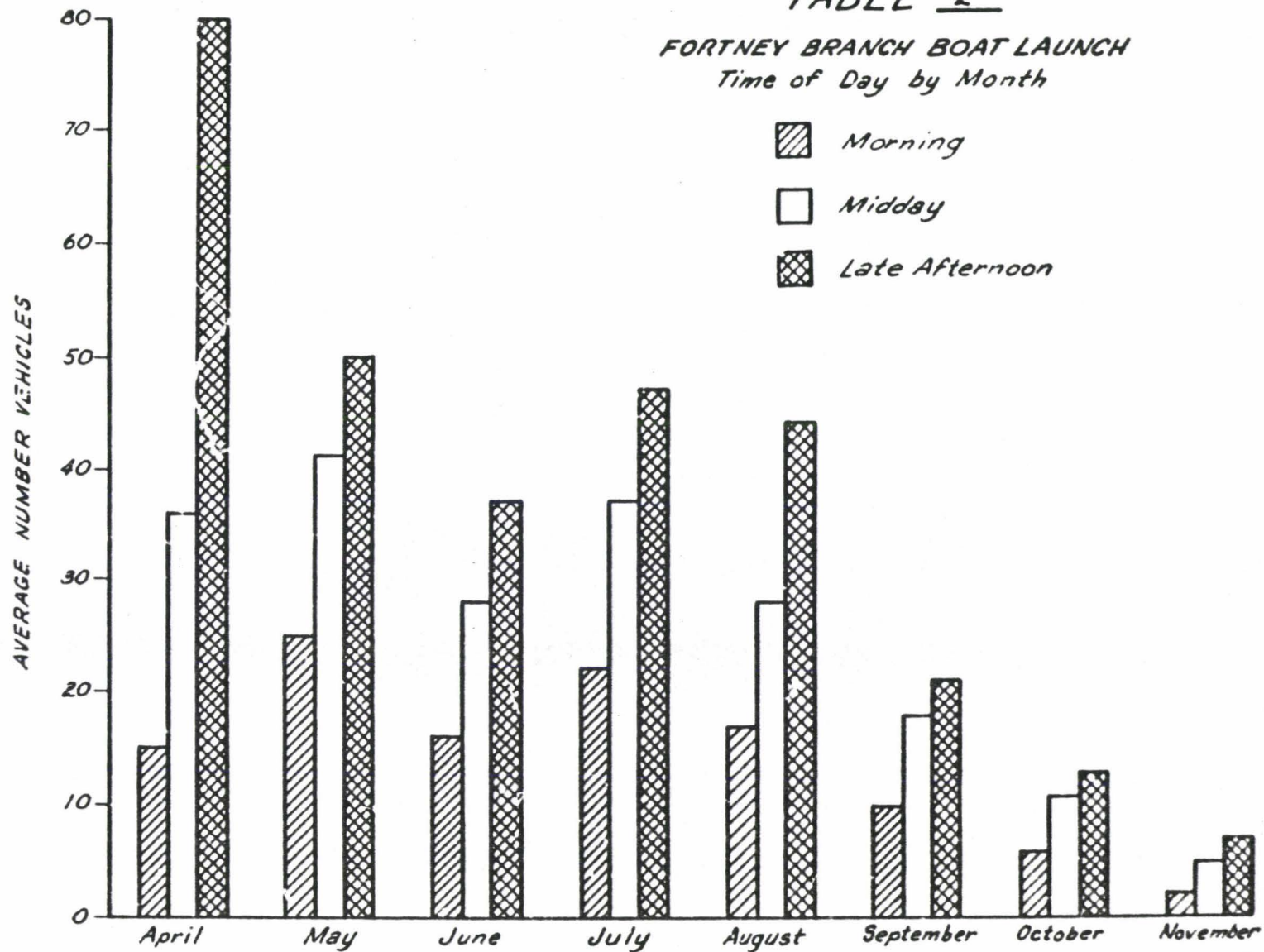


TABLE 3

BOLAR FLATS BOAT LAUNCH

Time of Day by Month

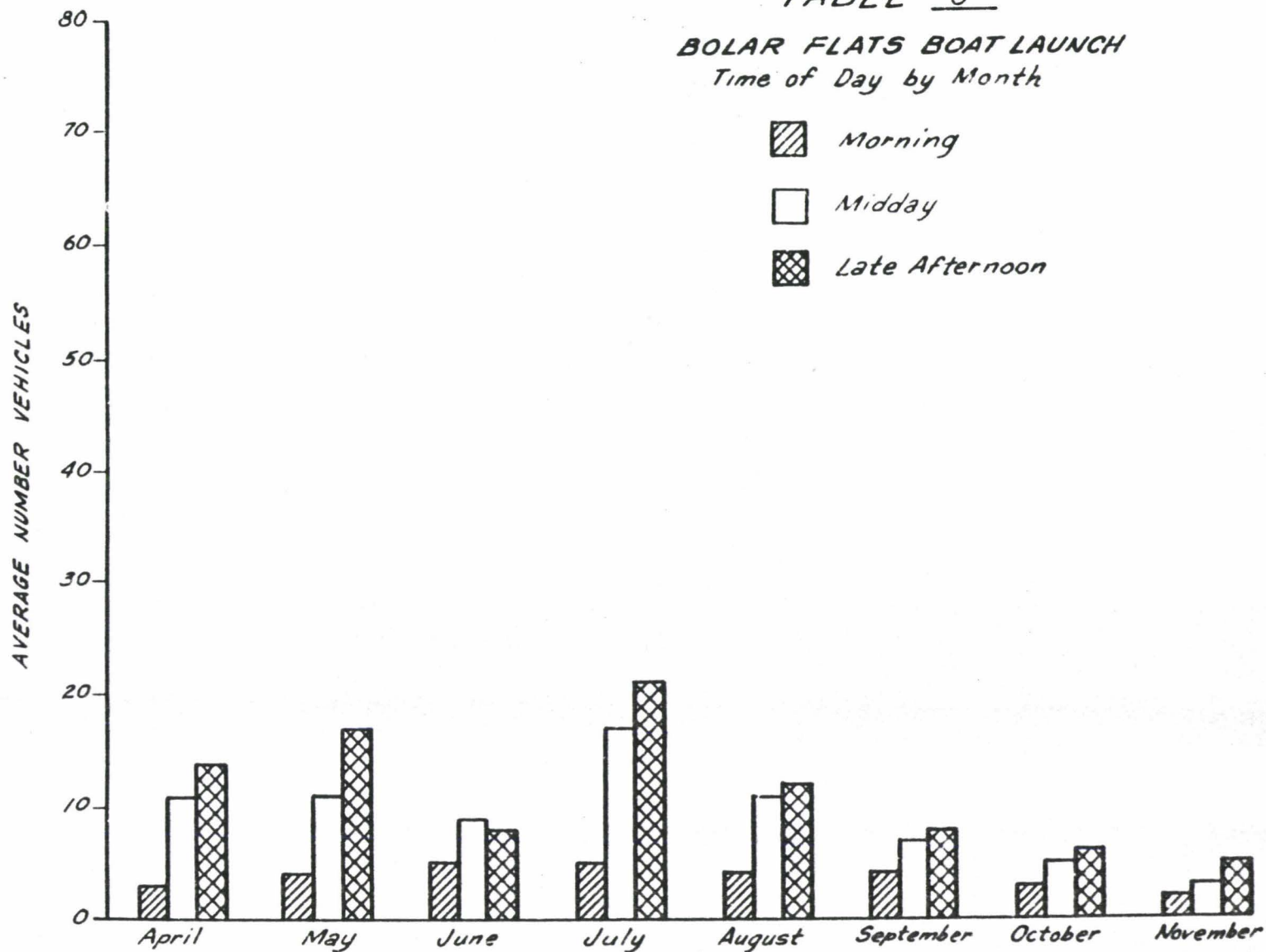
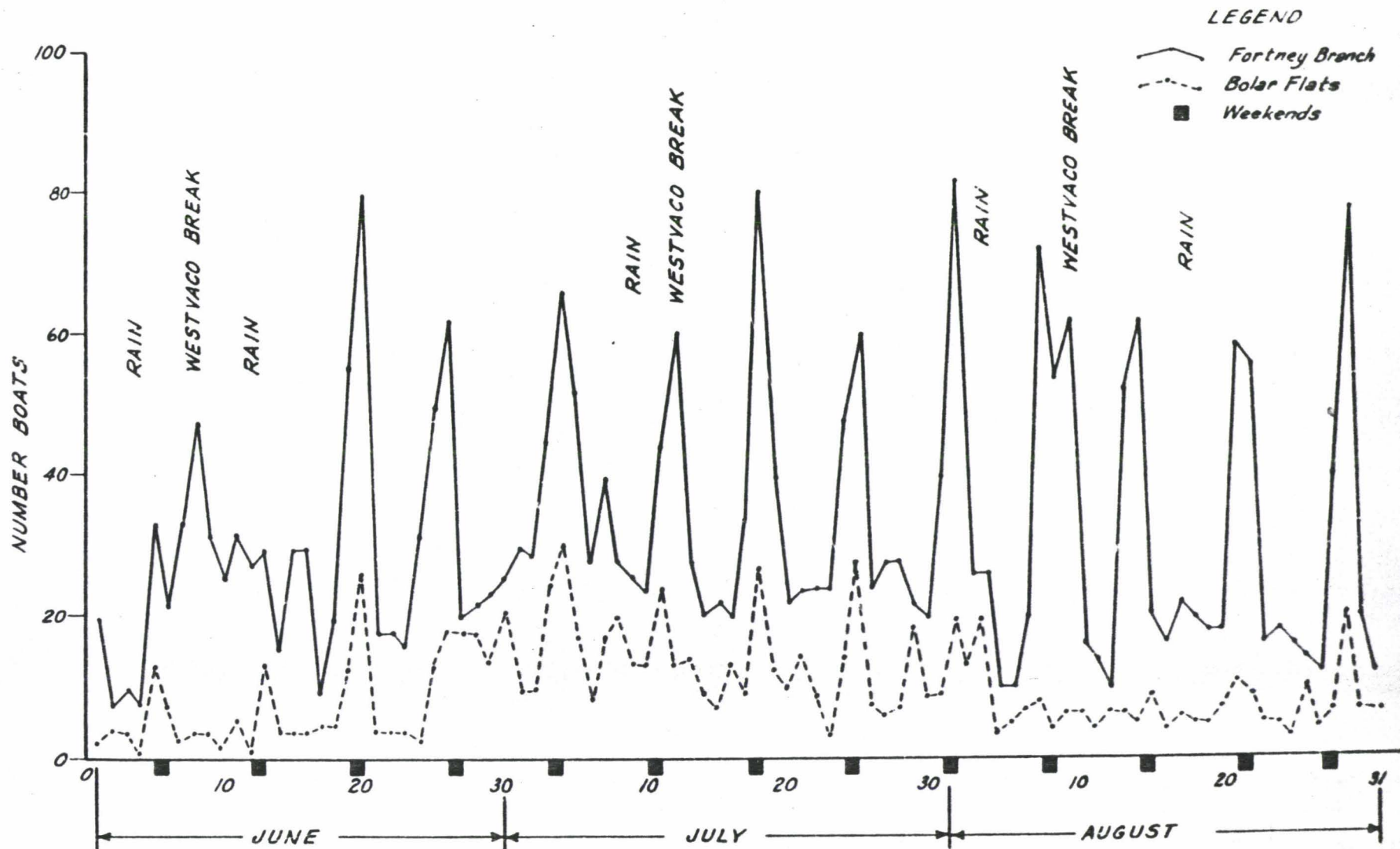


TABLE 4
AVERAGE BOAT LAUNCH PER DAY



Recreation Visitor Day use of the two boat launch sites during 1982 were:

Fortney Branch ----- 33,117 RVD*

Bolar Flats ----- 7,477 RVD*

This use reflected the close proximity of Fortney Branch to the area with the greatest population and boat registration. The influence of shift changes and long monthly breaks at Westvaco can also be noted in the use data for Fortney Branch.

LAKE CAPACITY

The developed parking facilities provided 112 parking spaces (30 car-only and 82 car and trailer) at Fortney Branch with no overflow area. The closest possible overflow area is one-half mile from the boat ramp and is not developed. Bolar Flats had 120 parking spaces (cars and trailers) with an additional 60 spaces in a grass overflow area adjacent to the developed parking area. From use data, approximately 25-30 percent of the campers brought boats with them when visiting the area. There were no boat launching facilities at the campgrounds. This created a developed capacity of 306 BOAT (Boats at one time) for the lake, based on available parking facilities.

The Optimum Carrying Capacity of the lake was calculated at 558 BOAT (Boats at one time) using the procedure developed by Urban Research Development Corporation for the Bureau of Outdoor Recreation in 1977. Optimum Carrying Capacity was defined in this study as the amount of recreation use of a recreation resource which reflected the level of use most appropriate for the utilization and protection of the resource and the satisfaction of the participant.

The Social Carrying Capacity of the lake was calculated using the procedure developed by Urban Research Development Corporation for the Corps of Engineers in 1980. (See Appendix B) This computed to be 354 BOAT (Boats at one time). Social Carrying Capacity was defined in this study as the use level of a recreation resource beyond which the user's expectation of the experience was not realized and the user did not achieve a reasonable level of satisfaction.

The developed parking capacity for boats was below the calculated Optimum and Social Carrying Capacities. However, campers with boats could eventually make up the difference.

*Computed using Jansen's method "Recreation Use Estimation - The Visitor Count Method" which utilized the TI-59 programmable calculator.

In the analysis of data and discussions with area users and area administrators some problems surfaced which management must deal with:

1. Lack of concession marina operation.
2. Insufficient parking at Fortney Branch to satisfy demand.
3. Difficulty of launching and retrieving sailboats at Fortney Branch.
4. No facilities at campgrounds for boaters (parking facilities).
5. Campers must tow boats from campgrounds to a launch point several miles away.
6. Congestion at Fortney Branch on holidays and week-ends.
7. Campers at Greenwood Point left vehicles at Fortney Branch parking lot (boat launch site).
8. Fishing at boat launch sites.
9. Impact on fishing tournaments.

CAMPING

The area has a total of 150 developed campsites. Greenwood Point (primitive camping) has five sites and is only accessible by boat for foot trail. The facilities consist of a boat dock and portable toilets. Each campsite contains a table, tent pad, and grill. The sites are well dispersed with a developed capacity of 25 PAOT (People at one time). There is room for expansion. The area operated in excess of developed capacity on week-ends and holidays and 30-50 percent of capacity on week days. This campground does not meet the criteria for charging fees (no drinking water available on site). Approximately three-fourth of its use originates from the south through Fortney Branch boat launch site. The majority of users are local, however this will change as it becomes better known. This was evident toward the end of summer when visitors from 50-75 miles away began to use this site. Campers at this site primarily engaged in boating, fishing, and general camp activities. Additional sites need to be developed at this location but should not exceed 25 sites (125 PAOT) to maintain the desired experience. The Optimum Capacity at this area is 25 sites (125 PAOT) while the Social Capacity is 20 sites (100 PAOT). Overdevelopment would eliminate the camping experience expected at this type of development. This area showed a tendency to develop into a late night party area. This problem will need to be dealt with by area administrators being scheduled to perform late night spot patrols. This area reported over 1900 RVD use in 1982.

Morris Hill Campground has 55 family campsites. Each site contains a parking spur, table, fireplace grill, lantern post, and tent pad. There are three water flush toilets with warm water showers, a trailer dump station, and water hydrants spaced through the area. The water system and sewage treatment plant is serviced by the Corps of Engineers. The area has one interior gate so part of the campground can be closed if not needed. Spacing between sites is approximately 75 feet. The area is 1.5 miles from Fortney Branch boat launch site. It is located on a wooded ridge above the lake. There is room for possible expansion by 50 sites if needed in the future.

No parking facilities were constructed for boats and trailers at the area. This created a hazard since campers parked this type of equipment along the interior campground road. There are no developed trails near this campground.

Morris Hill operated at approximately 14 percent of developed capacity in 1982. The area had an estimated 12,900 RVD use in 1982. The average length of stay was three days and the average size of each group was 4.3 people. (Table 5 & 6)

This section of the George Washington National Forest is very popular with hunters. Game available in the area include squirrel, white tailed deer, turkey, black bear, and ducks. However, the water system and toilet buildings are not constructed for freezing weather. Therefore this campground must be closed before the main hunting season starts.

Bolar Mountain contains 90 campsites of which 21 have electric hookups. Each site contains a parking spur, tent pad, table, lantern post, and grill. Five sites are double sites. There are three boat docks, two trailer dump stations, and water flush toilets with warm showers. These areas are served by one sewage treatment plant. This camping complex is divided into three campgrounds and has gates where sections can be closed or opened as needed. Bolar Mountain is on the north side of the lake and the sites are all wooded and vary from lake shore up to 200 feet from the edge of the water. Spacing between sites vary from 50 feet up to 125 feet with an average of 75 feet. There is a 5 mile hiking trail close to this campground. This campground has no parking facilities for boats and trailers and no launching facilities for boats. Campers must launch their boats from Bolar Flats, approximately 5 miles from the campground. They must park their boat trailers outside the campgrounds due to lack of space within the camping area. The area operated at about 30 percent of developed capacity with an estimated use of 48,600 RVD. The average length of stay was four days and the average size of the groups was 4.6 people. There is no room for expansion. These sites were the most popular in 1982 and was attributable to the close proximity to the water. Since the water and sewage system was not constructed for operation in freezing weather this camping area, like Morris Hill must be closed early in the fall. (Table 5 & 6)

TABLE - 5 - ACTIVITIES ENGAGED IN

C A M P G R O U N D

Activities	Morris Hill	Bolar Mountain
Boating	32.8%	21.2%
Fishing	21.2%	27.3%
Bicycling	4.4%	6.2%
Swimming	3.3%	27.2%
Motorbiking	2.2%	1.7%
Hiking	1.7%	0.9%
Other*	34.4%	15.5%

*Includes:

- a. Sleeping
- b. Cooking and/or eating
- c. Relaxing and/or reading
- d. Watching campfire
- e. Bird watching
- f. Visiting other campers

TABLE 6 TYPE OF CAMPING EQUIPMENT

Equipment	Morris Hill	Bolar Mountain
Tent	49.0%	42.5%
Pop-up tent trailer	11.8%	10.7%
Trailer	21.6%	18.1%
Truck campers	6.6%	18.2%
Station wagon	0.6%	0.6%
Motor home	3.3%	4.9%
Van camper	6.5%	4.9%
Other air (sleeping bags)	0.6%	0.1%

A survey of the origin of campers visiting Gathright Dam and Lake Moomaw (Morris Hill and Bolar Mountain) showed:

A. Distance Traveled:

1. Less than 50 miles ----- 57%
2. Greater than 50 miles -- 43%

B. Home

1. Resident - (Virginia ----- 77%
2. Non-Resident - (Outside Virginia) ----- 23% *

*Non-Resident Visitation - (19 states and two foreign countries)

West Virginia ----- 68%
 Ohio ----- 7.0%
 Maryland ----- 5.0%
 North Carolina ----- 3.0%
 Pennsylvania ----- 2.5%
 Tennessee ----- 2.0%
 Florida ----- 1.5%
 Michigan ----- 1.5%
 Massachusetts ----- 1.5%
 Kentucky ----- 1.5%
 Indiana ----- 1.0%
 New York ----- 1.0%
 Utah ----- 0.5%
 Connecticut ----- 0.5%
 Missouri ----- 0.5%
 Texas ----- 0.5%
 New Jersey ----- 0.5%
 California ----- 0.5%
 Foreign Countries** ----- 1.5%

**Canada and Norway

There are no developed group camping areas in either complex. This creates a conflict with families when groups move into the family campgrounds.

OVERFLOW CAMPING

There is one overflow camping area, McClintic Point, on the north shore of the lake. There is no charge for use of this area. It has a capacity of 125 PAOT. The area is open with some young vegetation (less than 20 feet in height). This area has no water or sanitation facilities. It should not be opened for use until the developed facilities on both the North and South Complex is 90 percent full. This overflow area has a potential of being developed to the degree where fees could be charged.

Tent camping comprises approximately 50 percent of campers using Gathright Dam and Lake Moenaw. Any additional developed camping should take this into consideration.

DAY USE

The South Complex has three picnic areas: Morris Hill picnic, Coles Mountain #1, and Coles Mountain #2. The season of use is Memorial Day to November 1 of each year. Morris Hill picnic area did not receive a single visitor during 1982. It is located on a wooded ridge above the lake with no access to the water. It has a developed capacity of 100 PAOT. The facilities consists of parking, tables, grills and garbage cans. Toilet facilities are shared with a Corps of Engineers picnic area adjacent to thr area.

Coles Mountain #1 contains two paved parking lots, 30 tables, 16 grills, two fountains, and garbage cans. The parking facilities have a capacity of 135 PAOT. In addition there is one picnic pavillion which contains 10 tables and oil flush toilets with holding tanks. The optimum capacity of this area is 200 PAOT but lack of parking facilities limit the capacity to 135 PAOT. Across the road from this picnic area is a small parking lot with eight spaces to serve a trail to a lake overlook. The overlook needs some vegetative manipulation to improve the view of the lake. The area had 2719 RVD in 1982 (computed by TI-59). The average group size using this area was 4.2. The turnover rate was 2.6 and each visit averaged 3.5 hours in length.

The oil flush toilets present problems in the administration of the area. They have to be checked a minimur of three times each day of operation. The chemicals and supplies necessary to operate are very expensive. Due to time involved in getting replacement chemicals and parts, it is necessary to maintain on hand \$1200 of spare parts and materials. This system is so constructed that the materials and parts are only available from one company.

This picnic area is located on a wooded ridge above the lake. Access to the lake is not available at this location. There is room to expand this facility in the future.

Coles Mountain #2 is designed the same as Coles Mountain #1. It is on a wooded ridge above the lake but access to the water is available by trail. It has a designed parking capacity of 150 PAOT. The optimum capacity is 200 PAOT. This area also has oil flush toilets and the same problems. This area is popular and had 3570 RVD in 1982. It has approximately the same turnover rate and average size group. The visits to this site is longer (4.6 hours) than Coles Mountain #1. This is attributed to closer proximity to the water.

There is room for expansion at this site and also between the two picnic areas. Camping could also be developed. Treated water from a drilled well serves both areas.

The pavilions are popular with groups and may be reserved under a group fee.

The road to Coles Mountain is open yearlong and some use occurs the entire year. This road provides access to Coles Point which is an undeveloped area. This area is used to launch and retrieve sailboats and bank fishing. Some swimming occurs at this site. The area recorded 3200 RVD in 1982.

The North Complex has three picnic areas: Bolar Flats picnic area, Bolar Mountain picnic #1, and Bolar Mountain picnic #2. Bolar Mountain Picnic #1 did not receive any use in 1982. The area was closed for most of the season due to water system problems but its facilities were not needed to satisfy demand. It has parking for 78 vehicles, a pavilion with oil flush toilets and one separate oil flush toilet. This area has a developed capacity of 390 PAOT. There is room for expansion. The area is divided into two sections; one on the lake shore and the other on a flat ridge above the lake. The lake is very accessible from this area. The toilets are oil flush and has the same problems as those in the South Complex.

Bolar Flats picnic area is adjacent to the boat launch on the north shore. The area contains both wooded and open areas on the lake shore. The area has a capacity of 250 PAOT with additional overflow parking available. The area contains one pavilion with oil flush toilets. This area is popular with boaters who use it for stops for picnics.

Bolar Mountain Picnic #2 is located on the lake shore and adjacent to the developed swimming beach. It has a designed parking capacity of 200 PAOT. There is one pavilion with water flush toilets. The area is wooded with some open areas. Users of the beach area use this site for picnics.

Bolar Mountain Swimming Beach is a semi-open area on the lake. The area has 171 paved parking spaces with an additional 112 overflow parking spaces. The beach is man-made with a narrow grass sunning area. The bathhouse contains warm showers and a change area with water flush toilets. This is the only developed beach on the entire lake. The use comes from campers and people in the area. People from the south use this beach and either drive or boat to it. The developed carrying capacity of this beach is 250 PAOT as limited by linear feet of shoreline. There is developed parking for 855 PAOT and overflow parking for an additional 560 PAOT. With the surplus in parking and the only beach on the lake, this area has the potential of being overused.

The data for the day use areas on the North Complex were not collected in a form that turnover rates and average size of groups could be accurately calculated. The data collectors lumped use for these picnic areas and beach on the same data form. The total use was calculated as 15,505 RVD. During the use season a few counts of people and vehicles were recorded by area. These counts indicated that 61 percent of the use can be attributed to the beach, 26 percent to Bolar Mountain Picnic #2, and 13 percent to Bolar Flats Picnic Area. The area administrator, workers in the area and district staff who visited the area during the use season were interviewed concerning the use of these areas. Based on their input these

figures are considered satisfactory for this study. The average number of people per car varied from 2.4 to 3.3, depending on month. July and August showed the highest number per car.

These areas, due to close proximity to water and swimming area, will be popular. However, it is not expected that picnic use will develop to fully utilize available facilities. Due to limited available swimming facilities the beach area will need controls established. Swimming at areas not developed for such activities will become a problem.

DISPERSED USE

Camping at undesignated areas on the lake is developing. To protect the shoreline and vegetation more primitive facilities are needed. Some possible sites include:

1. Expansion of Greenwood Point.
2. Hughes Draft.
3. Grivers Ridge.
4. Morris Hill Cove.

Lake patrols will need to be instituted to control and/or eliminate use in certain areas. There are problems with hunters on the lake during big game season. More patrols by the Game Commission and Forest Service are needed during this use period.

Bank Fishing is available at only a few places on the lake. This activity is very popular in the area, particularly at Coles Mountain Point, Fortney Branch and in the upper areas of the lake. Fisherman access trails and fishing pressure points need to be established. In addition more fish reefs need to be established in different sections of the lake. Fish attractors made from old tires could be used to develop the reefs very economically.

Bass Fishing Tournaments are beginning to catch on as this lake becomes known. It will become more popular as the bass fishing improves. Such tournaments need to be controlled to insure no interference with other activities and people at this facility. This can be done under a special use permit for recreation events. These are charge permits.

GENERAL

The total visits to Gathright Dam and Lake Moomaw were approximately 140,000 in 1982. This compares favorably with the COE (Corps of Engineers) prediction for this area. However, the mix of use was different than predicted by the COE. (See Table 7) Boating and camping use was higher than predicted and picnicking was less. Driving for pleasure and sightseeing was high due to the fact that this was a new area. These activities will probably decrease over time. The picnic facilities were not utilized as heavily as predicted.

Table 7

Actual Use Compared with COE Projection

Activity	COE Projection	1982 Actual
Boating	12%	23%
Camping	9%	36%
Picnicking	22%	8%
Swimming	25%	5%
Other*	32%	28%

*Driving for pleasure, sightseeing

The use of the TI-59 programmed calculator was tested with data collected to determine use. It appears to be a quick and economical procedure to calculate RVD of use. Its accuracy is satisfactory for boating, camping and swimming. It is not as accurate with picnicking and dispersed use due to erratic use.

Economic Benefits to Local Area

This recreation complex was responsible for the development of two boat sale businesses, one sporting supply business, two fish bait businesses, and expansion of four country type stores. To date it has not attracted any large industry to the area but enters into consideration by local industry due to recreation facilities provided which workers can use.

According to Vance D. High of the "Covington Virginian" newspaper the area did have a positive effect on the local economy. He reported that in 1982 local businesses credited approximately \$800,000 of their income to the lake. The local fishing license sales for residents increased by 93 percent over 1981 and sales to nonresidents increased by 286 percent. This increase in fishing licenses can be attributed directly to the influence of the lake. As fishing improves this trend will continue.

The U. S. Forest Service collected over \$27,000 in camping fees in 1982. Charges were \$5.00 per campsite per day except the sites with electric hookups which were \$7.00 per site per day. Swimming was \$1.00 per car per day. The pavilions could be reserved at \$10.00 per 50 people. The North Complex has an entrance station at Bolar Mountain which can be used effectively to collect fees from people entering the area by car. However, a significant number of swimmers come from the South Complex by boat.

A concession marina operation was advertised in the spring of 1982. No bids were received from advertisement. A telephone survey of individuals who had expressed an interest revealed the following factors for not bidding:

1. Interest rates were too high for such an investment.
2. The best potential site for making a profitable business was Fortney Branch and it was too congested with existing use.
3. Bolar Flats had room for such an operation but would have to rely entirely on campers.

Some individuals suggested such an operation at Coles Mountain Point. However, this area was not considered due to close proximity to the two picnic areas. However, it could complement these two areas. This area should be considered for such a development.

The City of Covington has applied to FERC (Federal Energy Regulatory Commission) for a permit to modify the dam to produce electricity. If such a permit

is approved, conditions must be part of the permit to insure no deterioration to the recreation potential of this lake.

The Jackson River below the dam has been declared navigable by the COE. The private landowners have challenged this in Federal Court. The District Court upheld the COE decision. At present this decision has been appealed to the 4th Circuit Court of Appeals. The COE acquired five sites along the river for public access. If the District Court decision is upheld this 23 miles of river will become popular with small boaters and fisherman. The Virginia Commission of Game and Inland Fisheries has predicted that this section of water has the potential of becoming one of the best trout fishing streams in the state.

The campgrounds, due to varied conditions and differences in relation to the water, lend themselves to differential pricing. The following table suggests such a system.

AREA	TOTAL SITES	5.00*	6.00*	7.00*	9.00*	Free
Morris Hill	55	55	—	—	—	—
Bolar Mountain #1	42	—	7	14	21	—
Bolar Mountain #2A	16	—	6	10	—	—
Bolar Mountain #2B	32	—	13	19	—	—
Greenwood Point	5	—	—	—	—	5
TOTAL	150	55	26	43	21	5

*Price Condition - Fee per Day

Wooded not on Lake — \$5.00

Wooded - within 200 feet of Lake — \$6.00

Wooded - on Lake shore — \$7.00

Electric hookups available — \$9.00

Such a system would increase the potential annual income from camping by \$10,000 per year above expected income based on 1982 fees. If picnic area #1 is converted to camping this would add an additional \$10,000 income per year.

Consideration should be given to the establishment of different fees for weekday and weekend-holidays if camping popularity increases to the point of overuse on weekend holidays. The weekday fee would be lower with the idea of increasing weekday use and eliminating some weekend demand.

CHAPTER V

SUMMARY AND CONCLUSIONS

Gathright Dam and Lake Moomaw is a new recreation development on which no use data are available. The new facilities had not been tested prior to the 1982 season to determine problems or deficiencies. Some of the facilities require close attention and are costly to operate and maintain. With cutback in funds and Human Resource Programs, use patterns need to be known to prepare schedules and provide the necessary protection and services most economically. Since this study covers an entire recreation complex it is primarily an overview and points out some areas where additional studies are needed. However, recommendations will be made for future direction on some areas. An economic analysis of existing management and recommended changes were made using Present Net Cost and Present Net Value (Appendix D).

Procedures and Findings

A review of the COE Design Memorandums and their predictions were made to determine why certain facilities were developed and the expected use. Data were collected at the various sites and analyzed for patterns of use and problems. It was found that population and boat registration tied directly in with use at day use areas. Managers of comparable recreation developments close to the study area were contacted to find out their use and capacities. It was found that Gathright Dam and Lake Moomaw had more picnic facilities developed than demand indicates are needed. Two picnic areas were not used at all during the 1982 season. The oil flush toilets were problem facilities and found to be costly to maintain. Materials and parts were hard to obtain which created the necessity of keeping a costly supply on hand at all times. It was thought that this type of toilet would permit operation in freezing weather but in actual use it was discovered that none of the restroom facilities could be operated in such weather due to design problems.

As predicted boating, fishing, swimming and camping are popular. Fortney Branch is overused by boaters and Bolar Flats is underutilized. Fishing is very popular since this is the only large body of water within 75 miles. The one swimming beach is popular and will become overused during peak use periods. Since most of the population is south of the project and the beach is on the north shore, boaters using the area created a problem in fee enforcement. The only location on the south shore where a beach could be developed is on Coles Mountain Point. It is a very small area and if so developed would quickly create overuse problems. This site could be better utilized in other ways.

As expected, the campgrounds on the North Complex are more popular than those on the South Complex. This is due to proximity to the water. This

area shows evidence of developing into a destination camping area. Primitive camping has proved to be very popular. There are insufficient primitive camping facilities available to satisfy demand. Additional trails need to be constructed to satisfy hiking needs. An opportunity exists for both short and long distance trails. The area can be hooked up with the Lake Sherwood Recreation trail net as well as the West Virginia Scenic Trail. A differential price system would lend itself to this area due to the varied conditions at the campgrounds. A portion of a campground at both the North and South Complex needs to be opened in the fall hunting season to satisfy hunter camper demands. No facilities were developed for group camping. This created problems with families and organized groups using the same campground.

Conclusions and Recommendations

Based upon the findings and within the limitations of this study the following conclusions are drawn:

Boating:

Fortney Branch is the most popular boat launch site on the lake and will continue to receive heavy use. Additional parking is needed to overcome congestion. A concession marina operation is needed on the lake. Care must be taken to insure that boating does not increase to where it exceeds the capacity of the lake. The following recommendations are made:

1. Develop overflow parking for boat trailers at Fortney — possible location 0.5 mile west of launch site. Prohibit parking along entrance road.
2. Man the boat launch site during peak periods on weekends and holidays.
3. Install an additional boat dock at the launch site.
4. Continue to permit sailboats, canoes, and john boats at Coles Mountain Point.
5. Advertise for a concession marina again and include Coles Mountain Point as a possible alternative site. Design for such activity is needed.
6. Install gate on entrance road so area can be shut during winter months when lake is frozen.
7. Coordinate use with North Complex to maintain use within capacity.
8. Require a special use permit for all fishing tournaments.
9. Install a timer to turn off lights in the parking lot at Fortney Branch.
10. Eliminate fishing from boat docks and swimming at boat launch sites.

Camping:

Camping on the north side of the lake is more popular due to the close proximity to the water. It is expected that use of the campgrounds will increase and the area will become a destination recreation area. The campgrounds do not contain facilities to park boat trailers with other camping vehicles. Also campers must go a long distance to launch their boats. Greenwood Point (primitive camp) and an area in Hughes Draft are popular with campers. Additional designated primitive camp areas are needed. The campgrounds contain campsites with different amenities. The sites range from lake shore sites to ridgetop sites to sites with electric hookup. The fee in 1982 was \$5.00 per day with \$2.00 extra at sites with electricity. Additional sites for camping will be needed in a few years. Group camping caused conflicts with family camping. There are no developed or designated group camp areas. The heaviest camp use is on weekends and holidays. The following recommendations are made:

1. Convert Morris Hill Picnic Area to a group campground and operate on reservation basis.
2. Convert Bolar Mountain Picnic Area #1 to tent camping and charge a fee.
3. Construct boat trailer parking within the campgrounds. Where necessary eliminate campsites to accommodate boat trailers. Where possible convert single spurs to double spurs. At least 40 percent of the units should have additional parking space provided.
4. Construct a boat launch site for campers near campground on the north side of the lake.
5. Begin to charge different fees at different campsites based on relationship to the lake (differential fees).
6. Modify at least one toilet building in both the north and south complex to operate in freezing weather (hunting season).
7. Schedule spot patrols late at night at all campgrounds, including Greenwood Point.
8. Do not open up an overflow area until the developed areas are at 90 percent of capacity.
9. Use volunteers in the campgrounds as hosts.
10. Schedule administrators to do fee compliance and meet visitors and train volunteers.
11. Construct more hiking trails in the area.
12. Operate entrance station on weekends and holidays — use a volunteer.

Day Use:

The study showed that more picnic facilities were constructed than apparent demand indicated. Two areas were not used at all during 1982. The oil flush toilets are expensive and require constant attention. The swimming beach is popular and use data indicate it will become overused in time. Swimmers boating to the area create problems with enforcement of user fees. The main use period of the beach is Memorial Day to Labor Day. The picnic areas show some use outside these periods but these areas are underutilized. Picnic sites can be expanded in the future if needed. Possibly such sites could be established on an island on a "Pack It In - Pack It Out" basis. The following recommendations are made:

1. Convert Morris Hill Picnic and Bolar Mountain Picnic #1 to group camping and tent camping and charge user fees.
2. When feasible convert the oil flush toilets to sealed vault or water flush toilets.
3. Check the oil flush toilets daily.
4. Continue to reserve the pavilions under the user fee system.
5. Operate from Memorial Day to Labor Day under full service and outside this season under reduced service.

General Recommendations

1. Due to transportation net continue existing administrative boundaries.
2. Administrators should develop close coordination on available facilities.
3. Operate the entrance station on the North Complex using volunteers. Volunteers cannot handle money but they can give information and see that users place fee envelopes in collection box.
4. Contract for the pickup and disposal of solid waste.
5. Prepare schedule of employees and volunteers to give maximum coverage of the area.
6. Use the TI-59 programmable calculator to compute RVD use for reporting.
7. Future consideration should address a more detailed cost analysis. Costs of operations and maintenance vary by units and areas.
8. Contract operation of sewage treatment plant in North Complex.

9. Include Picnic Area #2 of Bolar Mountain with swim site and manage as part of swim area under the user fee system.
10. Consider putting swim site under concession marina advertisement package.

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APPENDIX — A

DATA COLLECTION FORMS

Campground _____ Date _____ Time _____ Weather Cond. _____

Site	Camp Equip. (a)	No. of Vehicles (b)	Activities (c)	No. of People (d)	Site	Camp Equip. (a)	No. of Vehicles (b)	Activities (c)	No. of People (d)
1					29				
2					30				
3					31				
4					32				
5					33				
6					34				
7					35				
8					36				
9					37				
10					38				
11					39				
12					40				
13					41				
14					42				
15					43				
16					44				
17					45				
18					46				
19					47				
20					48				
21					49				
22					50				
23					51				
24					52				
25					53				
26					54				
27					55				
28					56				

Camp Equipment (a)

1. Tent
2. Pop up tent trailer
3. Trailer
4. Truck camper
5. Station wagon
6. Motor home
7. Van camper
8. Open air

Activities Observed (c)

1. Boating
2. Fishing
3. Hiking
4. Swimming
5. Bicycling
6. Motorbiking
7. Other (code here and list number in space)

BOAT LAUNCH

Area: _____

Month: _____

[illegible]

Weather:

Cool = C

Month: _____

[illegible]

LAKE USE

Area: _____

Month: _____

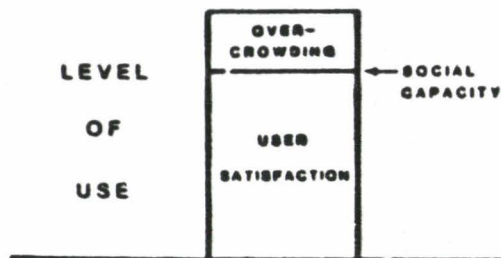
[illegible]

CARRYING CAPACITY

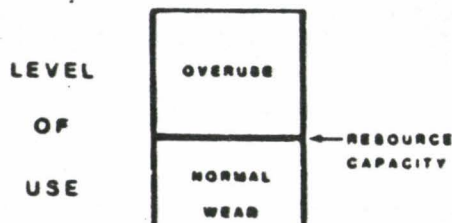
THE CONCEPT OF CARRYING CAPACITY

Two components make up carrying capacity: social capacity and resource capacity.

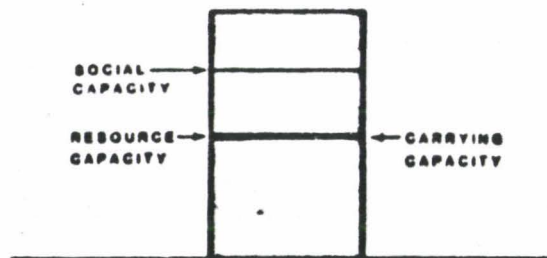
Social capacity is the level of use of a recreation resource beyond which the user does not achieve a reasonable level of satisfaction. Overcrowding occurs when social capacity is exceeded:



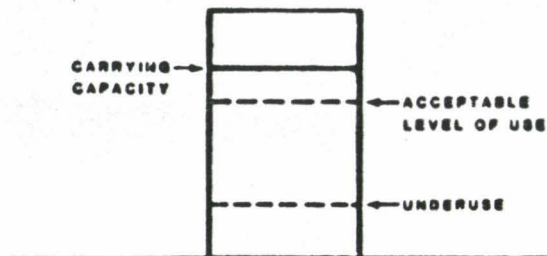
Resource capacity is the level of use of a recreation resource beyond which irreversible biological deterioration takes place or degradation of the resource makes it unsuitable or unattractive for recreational use. Overuse occurs when resource capacity is exceeded:



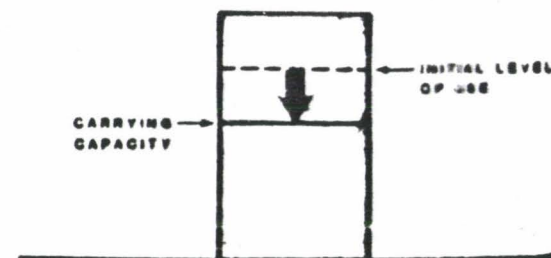
If there is a difference between resource and social capacities, then carrying capacity would be determined by the lesser of the two.



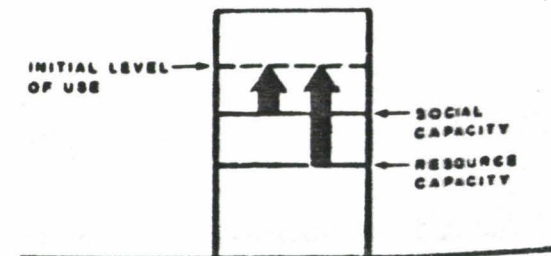
Carrying capacity is the maximum potential level of use which avoids overcrowding and overuse. The level of use at carrying capacity need not be achieved, but an area is underused if the level of use is significantly below the carrying capacity of the area:



However, the level of use should not exceed the carrying capacity of an area. If it is exceeded, (1) the level of use can be decreased:



and/or (2) the social capacity, resource capacity, or both can be increased:



[illegible]

I. Physical Settings:

A. Project Accessibility

1. Within Metropolitan Area
2. Within 50 Miles of Metropolitan Area
3. Within 100 Miles of Metropolitan Area
4. Beyond 100 Miles of Metropolitan Area

B. Distance to Expressway

1. 0- 5 Miles
2. 6-25 Miles
3. 26-50 Miles
4. 51-75 Miles
5. 75+ Miles

C. Distance to State/Local Highway

1. 0- 1 Mile
2. 2- 5 Miles
3. 6-10 Miles
4. 10+ Miles

SOUTH COMPLEX					NORTH COMPLEX								
Fortenry Branch Boat Launch	Morris Hill Camping	Morris Hill Picnic	Coles Mtn. Picnic #1&2	Coles Mtn. Point	Bolar Flats Boat Launch	Bolar Flats Picnic	Bolar Mtn. Picnic #I	Bolar Mtn. Camping #I	Bolar Mtn. Picnic #II	Bolar Mtn. Beach	Bolar Mtn. Camping #II	Bolar Mtn. Camping #III	Greenwood Point Camping
x	x	x	x	x	x	x	x	x	x	x	x	x	x
x				x	x	x			x	x			
	x	x	x				x	x			x	x	x
x			x	x	x	x	x	x	x	x	x	x	x
	x	x											
x				x	x	x		x	x	x	x	x	x
	x	x	x				x						

1. Level (0-5%)
2. Moderate (5-10%)
3. Steep (10+%)

1. Open
2. Moderate
3. Dense

1. Easily Accessible
2. Moderate Accessible
3. Relatively Inaccessible

1. Unobstructed View
2. Partially Obstructed View
3. Obstructed View

IV. Activity/Use Relationship Settings:

A. Predominate Use of Area

1. Camping
2. Day Use

B. Relationship to Other Activity Areas

1. Activity Sharing Same Location with Other Activities
2. Activity Separate from but Adjacent to Other Activity Areas
3. Activity Isolated from Other Activity Areas

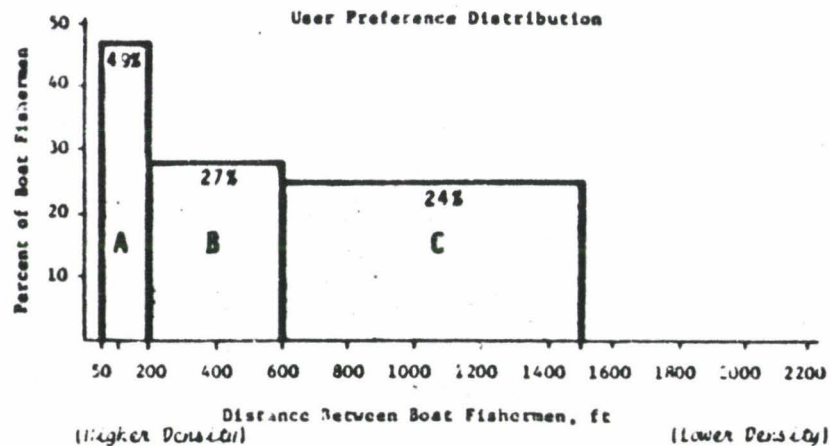
C. Level of Use Situation

1. Overcrowded
2. Over Used
3. Overcrowded and Over Used
4. Well Balanced
5. Under Used

SOUTH COMPLEX					NORTH COMPLEX								
Fortney Branch Boat Launch	Morris Hill Camping	Morris Hill Picnic	Coles Mtn. Picnic #1&2	Coles Mtn. Point	Bolar Flats Boat Launch	Bolar Flats Picnic	Bolar Mtn. Picnic #I	Bolar Mtn. Camping #I	Bolar Mtn. Picnic #II	Bolar Mtn. Beach	Bolar Mtn. Camping #II	Bolar Mtn. Camping #III	Greenwood Point Camping
x	x	x	x	x	x	x	x	x	x	x	x	x	x
	x	x		x	x	x	x	x	x	x	x	x	
x			x										x
x													
				x						x			x
	x	x	x		x	x	x	x	x		x	x	



BOAT FISHING

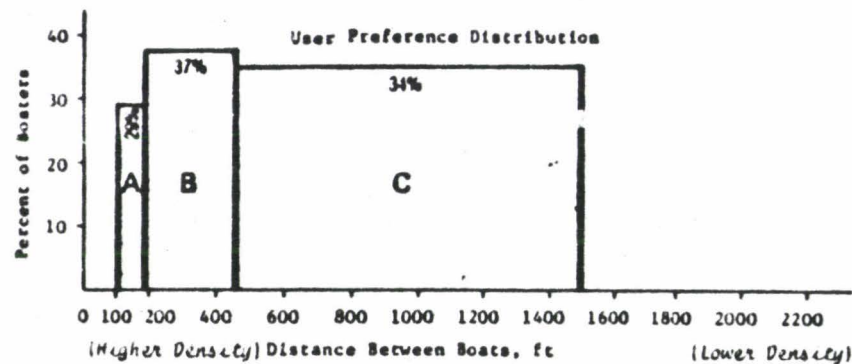


Social Capacity Factors Table

Site Characteristics	Variance	User Characteristics	Variance
Amount/Location of Facilities		Number of other Activities	
Pleasant	- 45	<1 (24%)	+195
Unpleasant	+450	2-3 (39%)	- 10
		>3 (37%)	-215
Degree of Control		Equipment	
High	-165	Power Boat ≤25hp (31%)	-115
Moderate/Low	+ 15	Power Boat >25hp (69%)	+ 70
Catching Fish		Group Size	
Pleasant	- 65	1-2 (54%)	+ 70
Unpleasant	+105	>2 (46%)	- 85
		Experience	
		None/Little/Some (31%)	+100
		Much (69%)	- 45
		Age	
		<26 (15%)	-100
		26-55 (65%)	+ 40
		>55 (20%)	- 55
		Travel Time	
		≤ 1 hr (53%)	+ 35
		>1 hr (47%)	- 40



BOATING



Social Capacity Factors Table

Site Characteristics	Variance	User Characteristics	Variance
Type of Area/Boat		Number of Other Activities	
Power	-35	<3 (48%)	+36
Nonpower	+156	>3 (52%)	-65
		Experience	
		None/Little (25%)	+60
		Some (22%)	-10
		Much (53%)	-25
		Travel Time	
		<30 min (39%)	-40
		>30 min (61%)	+25
		Age	
		<26 (22%)	-35
		26-55 (70%)	+13
		>56 (8%)	0
		Group Size	
		1-2 (17%)	-20
		>2 (83%)	+5

User Survey Preferred Distance Responses - Summary by Activity

ACTIVITY	PLANNING RANGE	PREFERENCE GROUP A			PREFERENCE GROUP B			PREFERENCE GROUP C			PREFERENCE GROUP D		
		Range	%	Midpoint	Range	%	Midpoint	Range	%	Midpoint	Range	%	Midpoint
Boating	100'-1500'	100'-199'	29%	150'	200'-450'	37%	325'	451'-1500'	34%	975'	-	-	-
Boat Fishing	50'-1500'	50'-199'	49%	125'	200'-599'	27%	400'	600'-1500'	24%	1050'	-	-	-
Boat Launching	3 min-30 min	3-7 min		5 min	8-15 min		10 min	16-30 min		23 min	-	-	-
Camping	20'-120'	20'-39'	20%	30'	40'-59'	28%	50'	60'-79'	31%	70'	80'-120'	21%	100'
Hiking	-	100'-199'	50%	200'	1200'-5000'	50%	3000'	-	-	-	-	-	-
Off-Road Vehicle Riding	Since there are no few responses (8) and they are not clustered, no Planning Range has been developed. Eliminating the outliers at each end of the range, produces a range of 50 feet to 660 feet. The mean of the responses in this range is 287 feet.												
Picnicking	20'-100'	20'-39'	23%	30'	40'-59'	42%	50'	60'-79'	20%	70'	80'-100'	15%	90'
Shoreline Fishing	10'-100'	10'-19'	20%	15'	20'-39'	38%	25'	40'-59'	24%	50'	60'-100'	18%	80'
Sunbathing	5'-50'	5'-14'	27%	10'	15'-20'	39%	18'	21'-30'	20%	26'	31'-50'	14%	40'
Swimming	5'-50'	5'-14'	25%	10'	15'-24'	41%	20'	25'-34'	19%	30'	35'-50'	15%	42'
Water skiing	100'-1500'	100'-199'	22%	150'	200'-400'	50%	300'	401'-1500'	28%	950'	-	-	-

*Percent of planning range.

Determination of
Lake Social Capacity

Boating:

(Power)

Factors	Observed Conditions	Effects of Observed Conditions
Type of Boat	Power	-35
		Net effect -35

New Mid-Points:	χ^2	Group Area Figure
Group A - 115 feet	"	= 13,225 sq. ft.
Group B - 290 feet	"	= 84,100 sq. ft.
Group C - 940 feet	"	=883,600 sq. ft.

Determination of Average Area for Power Boating:

$[(13,225 \times 0.29) + (84,100 \times 0.37) + 883,600 \times 0.34)] =$
 335,376 sq. ft. (7.70 acres) per boat (Power) or density
 of about 0.129 boats per acre.

Boating:

(Non-Power)

Factors	Observed Conditions	Effects of Observed Conditions
Type of Boat	Non-Power	+156
		Net effect +156

New Mid-Points:	χ^2	Group Area Figure
Group A - 306 feet	"	= 93,636 sq. ft.
Group B - 481	"	=231,361 sq. ft.
Group C - 1131	"	=1279,161 sq. ft.

Determination of Average Area for Non-Power Boating:

$[(93,636 \times 0.29) + (231,361 \times 0.37) + 1279,161 \times 0.34)] =$
 547,673 sq. ft. (12.57 acres) per boat (Non-Power) or
 density of about 0.080 boats per acre.

Waterskiing:

Factors	Observed Conditions	Effects of Observed Conditions
Amount/Location of Facilities	Pleasant	-5
Level of Development	High	-75
		Net effect -80

New Mid-Points:	χ^2	Group Area Figure
Group A - 70	"	= 4,900 sq. ft.
Group B - 220	"	= 48,400 sq. ft.
Group C - 870	"	=756,900 sq. ft.

Determination of Average Area for Waterskiing: $[(4900 \times 0.22) + (48400 \times 0.50) + 756900 \times 0.28)] =$ 307210 sq. ft.
 (7.05 acres) per boat (waterskiing) or density of about
 0.142 boats per acre.

Boat Fishing:	Factors	Observed Conditions	Effects of Observed Conditions
	Catching Fish	Pleasant	-65
	Amount/Location of Facilities	Pleasant	-45
	Degree of Control	Moderate	+15
			Net effect -95
New Mid-Points:		χ^2	Group Area Figures
Group A - 30		"	= 900 sq. ft.
Group B - 305		"	= 93025 sq. ft.
Group C - 955		"	= 912025 sq. ft.

Determination of Average Area for Boat Fishing: $[(900 \times 0.49) + (93025 \times 0.27) + (912025 \times 0.24)] = 244444$ sq. ft.
 (5.61 acres) per boat (boat fishing) or density of about 0.178 boats per acre.

Assumptions:

Due to controls Lake Moomaw is divided into two zones or areas of control:

- No Wake Areas (coves, etc.) ----- 500 acres
- Main Lake Area----- 2030 acres

NO WAKE AREA (Cove Area):

- Will not be used by waterskiers.
- 80% of users will be by fishermen.
- 10% of users will be by Non-Power Boaters.
- 10% of users will be by Power Boaters.

Determination of Social Capacity of Cove Area:

$(7.70 \times 0.10) + (12.57 \times 0.10) + (7.05 \times 0.80) = 7.70$ acres per boat or density of 0.130 boats per acre.

Area of Coves \div Acres per boat = Capacity of Cove
 $500 \div 7.70 = 65$ BOAT (boats at one time)

MAIN LAKE AREA:

- Waterskiing ----- 13%
- Boat (non-power)- 5%
- Boat (power) ----- 42%
- Boat Fishing ----- 40%

Determination of Social Capacity of Main Lake Area:

$(7.05 \times 0.13) + (12.57 \times 0.05) + (7.70 \times 0.42) + (5.61 \times 0.40) = 7.02$ acres per boat or density of 0.142 boats per acre.

Area of Main Lake \div Acres per boat = Capacity of Main Lake $2030 \div 7.02 = 289$ BOAT (boats at one time).

SOCIAL CAPACITY FOR LAKE MOOMAW:

Cove Area	=	65 (BOAT)
Main Lake Area	=	<u>289</u> (BOAT)
TOTAL		354 BOAT

APPENDIX

DETERMINATION OF LAKE OPTIMUM CAPACITY

Activity	Use Main Lake Area	Use Cove Area	Factor*
Boating (Non-Power)	5%	10%	1.3 acres/boat
Boating (Unlimited Power)	42%	—	9.0 acres/boat
Boating (Fishing)	40%	80%	2.0 acres/boat
Boating (Skiing)	13%	—	12.0 acres/boat
Boating (Limited Power)	—	10%	4.3 acres/boat

*Factors given by Urban Research and Development Corporation for Bureau of Outdoor Recreation - 1977

MAIN LAKE AREA - (2030 acres)

$$\begin{aligned}
 \text{Acres/boat} &= (1.3 \times 0.05) + (9.0 \times 0.42) + 2.0 \times 0.40 + (12.0 \times 0.13) \\
 &= 0.07 + 3.78 + 0.80 + 1.56 \\
 &= 6.21 \text{ acres/boat}
 \end{aligned}$$

$$2030 \div 6.21 = 327 \text{ BOAT (Boats at One Time) - Main Lake}$$

COVE LAKE AREA - (500 acres)

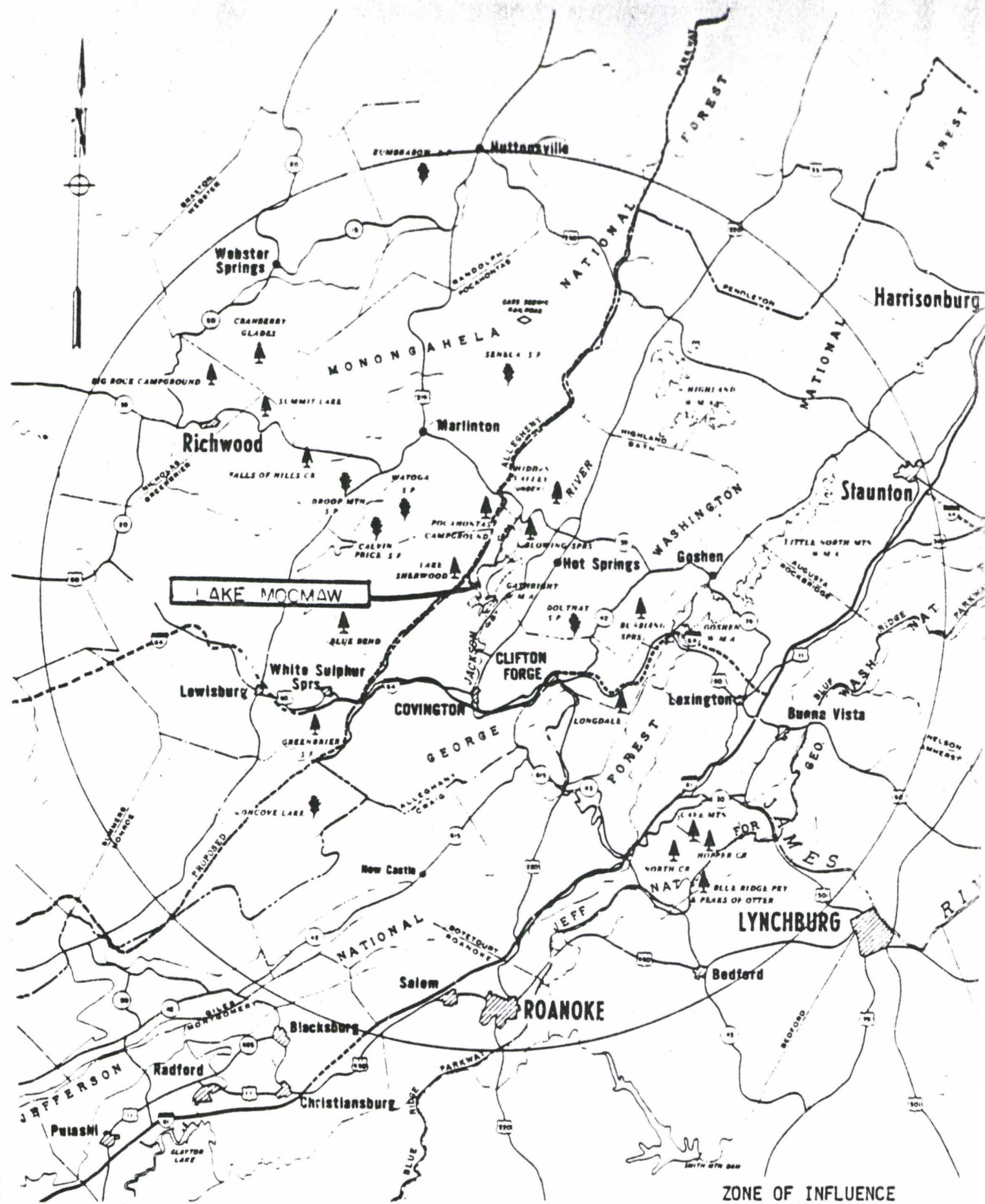
$$\begin{aligned}
 \text{Acres/boat} &= (2.0 \times 0.80) + (1.3 \times 0.10) + (4.3 \times 0.10) \\
 &= 1.60 + 0.13 + 0.43 \\
 &= 2.16 \text{ acres/boat}
 \end{aligned}$$

$$500 \div 2.16 = 231 \text{ BOAT - Cover Area}$$

$$\text{Total Optimum Capacity} = 327 + 231 = 558 \text{ BOAT}$$

APPENDIX — C

ZONE OF INFLUENCE



ZONE OF INFLUENCE

Gathright Dam and Lake Moomaw

SCALE IN MILES

1 2 3 4 5

APPENDIX --- D

COST AND BENEFIT ANALYSIS
(Present Net Value)

APPENDIX - D

A Cost-Benefit Analysis was prepared for two alternatives. Alternative A: Manage Area as transferred from the Corps of Engineers. Alternative B: Manage Area with recommended changes.

Estimate of use by activity were made for the period 1982 through 1991 based on use for 1982 and the first eight months of 1983. The RPA dollar value of \$3.00 per R.V.D. was used to determine benefit dollars. Additional benefits included income from user fees, firewood sales and a pasture permit.

Estimate of costs for the two alternatives were made based on 1982 cost factors and estimated cost of changes (Alternative B). Costs were adjusted to reflect increase in costs in future years.

The Benefit-Cost ratio for the 10 year period was discounted at 7.62 percent.

BENEFIT COST RATIO BY MANAGEMENT ALTERNATIVE

ALTERNATIVE	BENEFIT	COST	BENEFIT/COST
A	4,116,211	2,119,773	1.942
B	4,629,224	2,061,937	2.245

Comparison of the Benefit Cost Ratio indicates that the recommended changes is the best alternative for future management.

GATHRIGHT DAM AND LAKE MOOHAW

ALTERNATIVE "A" - MANAGE AREA AS TRANSFERRED FROM COE

BENEFITS	82	83	84	85	86	87	88	89	90	91	TOTAL
(\$ VALUE)	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
1. Camping	184,500	212,175	233,400	237,000	240,000	246,000	255,000	255,000	255,000	255,000	2,473,075
2. Picnicking	46,608	48,000	40,500	51,000	51,000	51,000	51,000	51,000	51,000	51,000	501,108
3. Swimming	28,374	36,000	36,000	36,000	36,000	36,000	36,000	36,000	36,000	36,000	352,374
4. Boating	62,259	74,709	82,179	90,000	90,000	90,000	90,000	90,000	90,000	90,000	849,147
5. Fishing	59,673	71,604	85,926	96,000	96,000	96,000	96,000	96,000	96,000	96,000	889,203
6. Other	38,400	33,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	311,400
\$ RETURN TO TREASURY											
1. Recreation	27,500	31,826	35,000	40,000	42,000	44,000	48,000	48,000	48,000	48,000	412,326
2. Timber (Firewood)	-	-	350	350	350	350	350	350	350	350	2,800
3. Concessionaire	-	-	250	250	250	250	250	1,000	1,000	1,000	4,250
4. Pasture Permit	232	232	232	232	232	350	350	350	350	350	2,910
\$ TOTAL BENEFITS	447,546	507,546	522,837	580,832	585,832	593,950	606,950	607,700	607,700	607,700	5,698,593
PRESENT NET VALUE	447,546	471,609	477,322	465,985	436,718	411,420	390,656	363,444	337,711	313,800	4,116,211
COSTS											
1. Site Administration	60,500	62,900	65,400	68,000	70,700	73,500	76,400	79,400	82,600	85,900	725,300
2. Operation	156,200	160,900	165,700	170,700	175,800	181,100	186,500	192,100	197,900	203,800	1,790,700
3. Maintenance	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	17,000	170,000
4. Facility Replacement	-	-	-	-	-	10,000	10,000	10,000	10,000	10,000	50,000
5. Major Rehabilitation	-	-	2,000	2,000	-	20,000	20,000	20,000	40,000	40,000	144,000
6. Road Maintenance	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	70,000
7. Sale Preparation	-	-	100	100	100	100	100	100	100	100	800
8. Sale Administration	-	-	150	150	150	150	150	150	150	150	1,200
9. Water Monitoring	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	10,000
10. Debris Removal	1,000	500	500	500	500	2,000	1,000	500	500	1,000	9,500
\$ TOTAL COST	242,700	249,300	258,850	266,450	273,750	311,850	319,150	327,250	356,250	365,950	2,971,500
PRESENT NET COST	242,700	231,648	223,500	213,765	204,071	216,013	205,417	195,717	197,975	188,967	2,119,773

ALTERNATIVE "B"
RECOMMENDED CHANGES

BENEFITS (\$ VALUE)	82 \$	83 \$	84 \$	85 \$	86 \$	87 \$	88 \$	89 \$	90 \$	91 \$	TOTAL \$
1. Camping	184,500	212,175	263,400	267,000	300,000	306,000	315,000	315,000	315,000	315,000	2,793,075
2. Picnicking	46,608	48,000	49,500	51,000	51,000	51,000	51,000	51,000	51,000	51,000	501,108
3. Swimming	28,374	36,000	36,000	36,000	36,000	36,000	36,000	36,000	36,000	36,000	352,374
4. Boating	62,259	74,709	82,179	90,000	90,000	90,000	90,000	90,000	90,000	90,000	849,147
5. Fishing	59,673	71,604	85,926	96,000	96,000	96,000	96,000	96,000	96,000	96,000	889,203
6. Other	38,400	33,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	311,400
\$ RETURN TO TREASURY											
1. Recreation	27,500	55,000	68,000	80,000	82,000	84,000	88,000	90,000	90,000	90,000	754,500
2. Timber (Firewood)	-	-	350	350	350	350	350	350	350	350	2,800
3. Concessionaire	-	-	250	250	250	1,000	1,200	1,500	1,800	2,000	8,250
4. Pasture Permit	232	232	232	232	232	350	350	350	350	350	2,910
\$ TOTAL BENEFIT	447,546	530,720	615,837	650,832	685,832	694,700	707,900	710,200	710,500	710,700	6,464,767
PRESENT NET VALUE	447,546	493,143	531,716	522,144	511,265	481,207	455,632	424,746	394,839	366,986	4,629,224
COST											
1. Site Administration	60,500	62,900	65,400	68,000	70,700	73,500	76,400	79,400	82,600	85,900	725,300
2. Operation	156,200	150,900	155,700	160,700	165,800	171,100	176,500	182,100	187,900	193,800	1,700,700
3. Maintenance	17,000	17,000	16,000	14,000	12,000	12,000	12,000	12,000	12,000	12,000	136,000
4. Facility Replacement	-	-	2,000	2,000	-	-	10,000	10,000	10,000	10,000	44,000
5. Major Rehabilitation	-	20,000	40,000	60,000	20,000	-	-	-	-	-	140,000
6. Road Maintenance	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	7,000	70,000
7. Sale Preparation	-	-	100	100	100	100	100	100	100	100	800
8. Sale Administration	-	-	150	150	150	150	150	150	150	150	1,200
9. Water Monitoring	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	10,000
10. Debris Removal	1,000	500	500	500	2,000	2,000	1,000	500	500	1,000	9,500
\$ TOTAL COST	242,700	259,300	287,850	313,450	278,750	266,850	284,150	292,250	301,250	310,950	2,837,500
PRESENT NET COST	242,700	240,940	248,531	251,472	207,799	184,843	182,890	174,785	167,411	160,566	2,061,937